Kožní pokryv
(Integumentum commune)
=
Kůže a kožní deriváty (adnexa)

Aleš Hampl
Říjen 2020

Funkční jednotka

Největší tělní systém

16% váhy těla

1,5 až 2 m^2

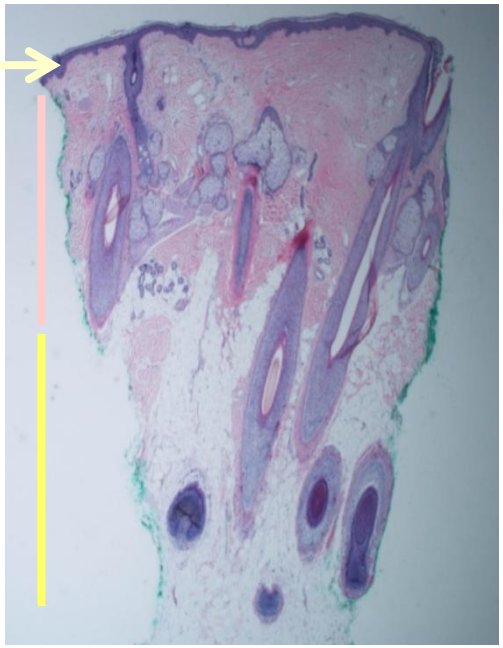
Integumentum commune
=
Kožní pokryv

Cutis
=
Kůže

Epidermis – rohovatějící vrstevnatý dlaždicový epitel

Dermis = Škára – vazivová složka

Tela subcutanea
=
Subcutis - Podkoží



Kožní adnexa
deriváty epidermis

- vlasy a nehty
- kožní žlázy (mazové + potní)
- mléčná žláza

Kůže = Kombinace 4 tkání

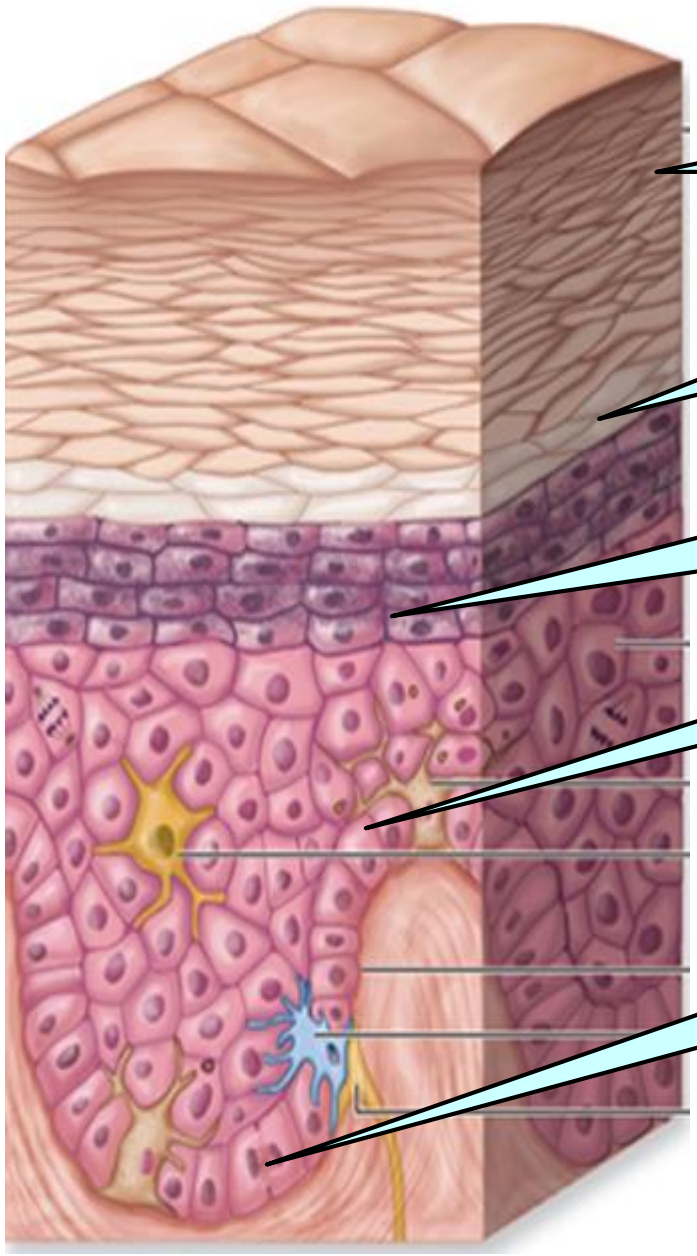
- Epitelová – outer layer
- Pojivová – underlies dermis
- Hladkosvalová – goose bumps
- Nervová – sensory receptors

Functions of the skin

1. **Regulation of body temperature**
   - Cellular metabolism produces heat as a waste product .
   - **High temperature**
     - dilate surface blood vessels
     - sweating
   - Low temperature
     - surface vessels constrict
     - shivering
2. **Protection**
   - physical abrasion
   - dehydration
   - ultraviolet radiation
3. **Sensation**
   - touch
   - vibration
   - pain
   - temperature
4. **Excretion**
5. **Immunity/ Resistance**
6. **Blood Reservoir**
   - 8-10 % in a resting adult
7. **Synthesis of vitamin D**
   - uv light
   - aids absorption of calcium

Epidermis - Vrstvy

Keratinizující vrstevnatý dlaždicový epitel
(keratinocytes – 4 or 5 layers)



5. Stratum corneum
- dead, flat cells full of keratin (25 to 100 layers)
- corneodesmosomes
- polar lipids - ceramides

4. Stratum lucidum
- more apparent in thick skin
- 3-5 layers of clear cells
- transitional state

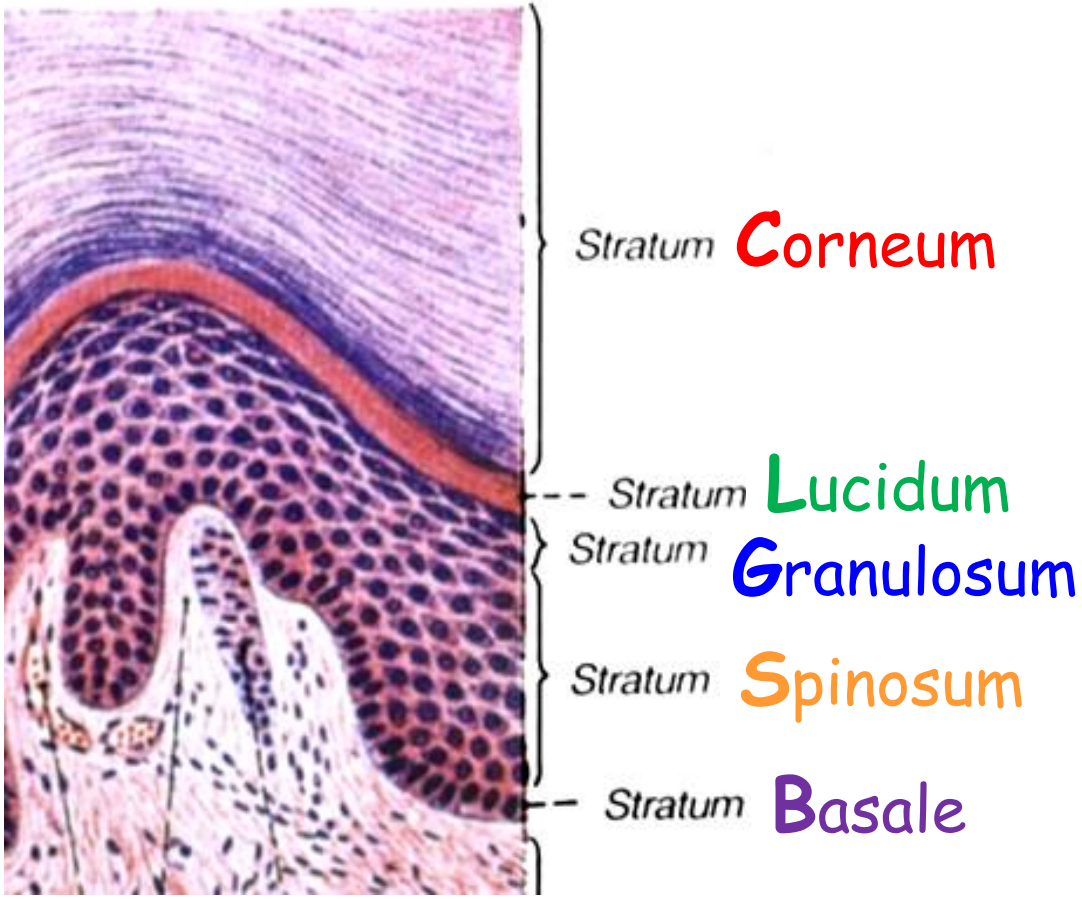
3. Stratum granulosum
- 3-5 layers
- tight junctions = zonulae accludentes
- keratohyalin found in granules
- cells beginning to die
- keratohyalin and lamellar granules

2. Stratum spinosum
- polygonal cells (keratines 1 and 10)
- 8-10 layers of keratinocytes
- desmosomes – shrinkage - spines

1. Stratum basale (germinativum)
- cylindrical cells – one layer (keratines 5 and 14)
- stratum germinativum
- the only proliferating cells (stem, progenitor)
- hemidesmosomes

Desquamation = Maturation (about 25 days)

Mnemotechnická pomůcka



Cancel

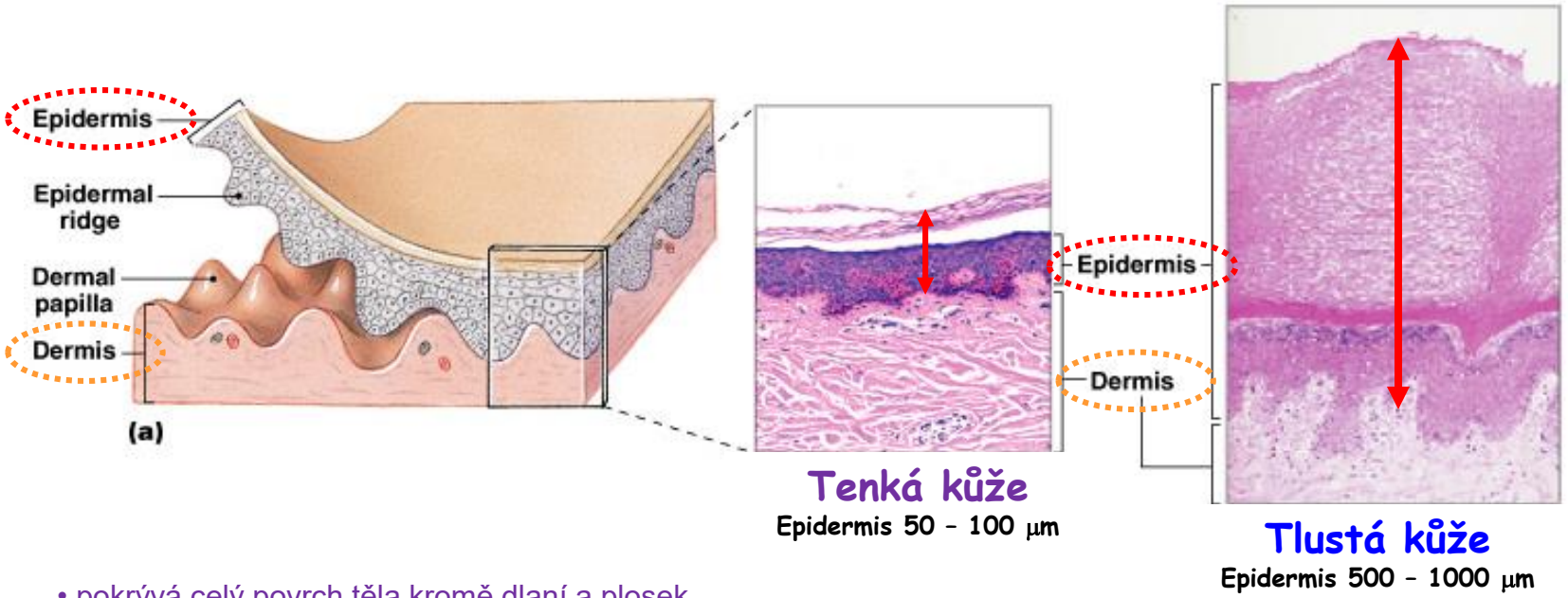
Lab !!!

Get

Some

Beer !!!

Epidermis (Pokožka) - Tenká x tlustá kůže



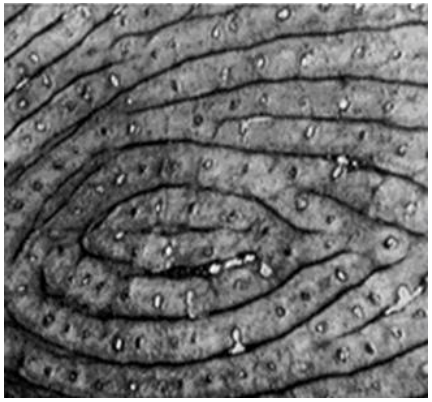
Tenká kůže
Epidermis 50 – 100 μm

Tlustá kůže
Epidermis 500 – 1000 μm

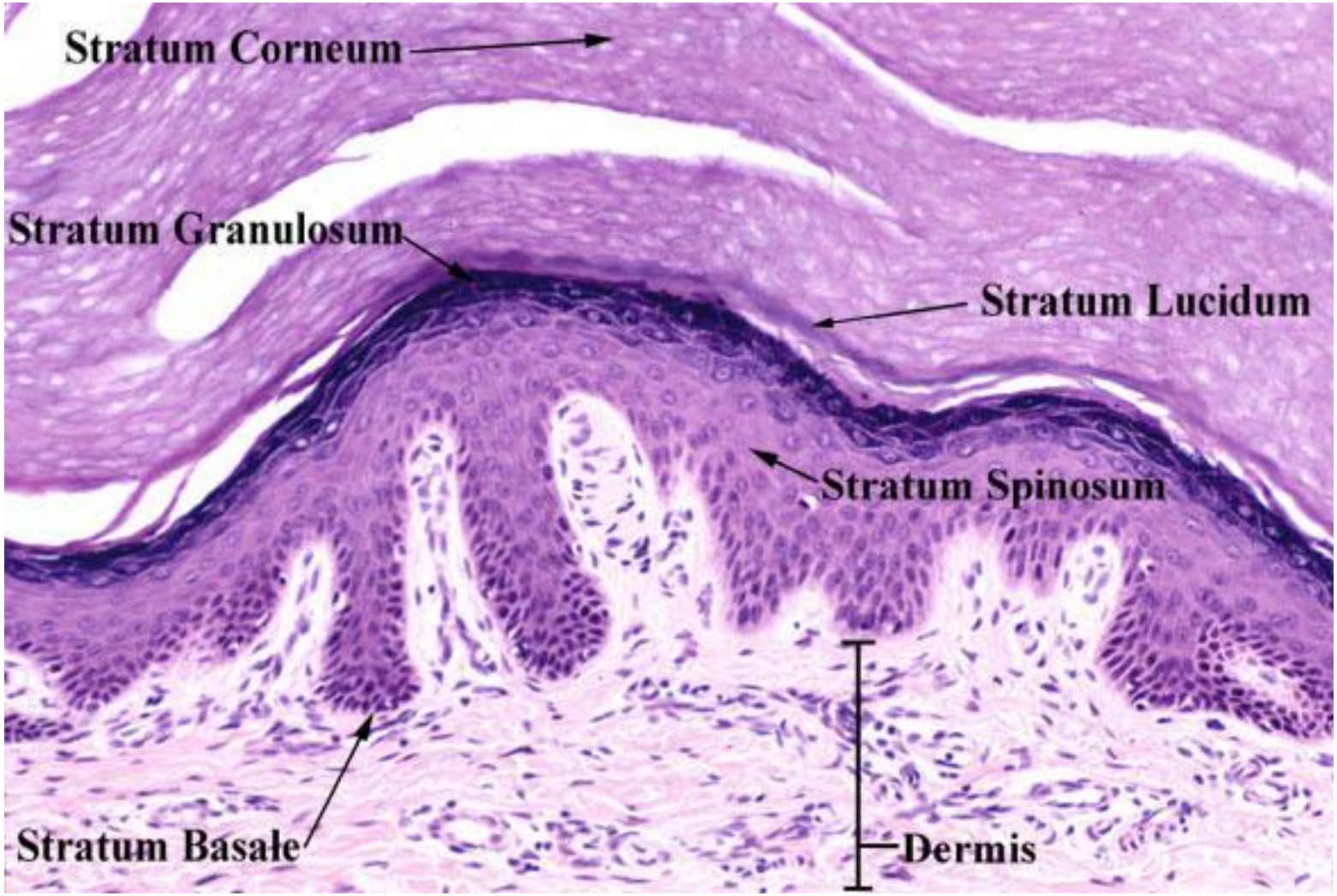
- pokrývá celý povrch těla kromě dlaní a plosek nohou
- typické **kosočtverečné políčkování**
- stratum corneum - méně než 25 vrstev buněk
- stratum lucidum chybí
- adnexa: potní žlázy + mazové žlázy + chlupy

(kromě rtů, glans penis, labia minora)

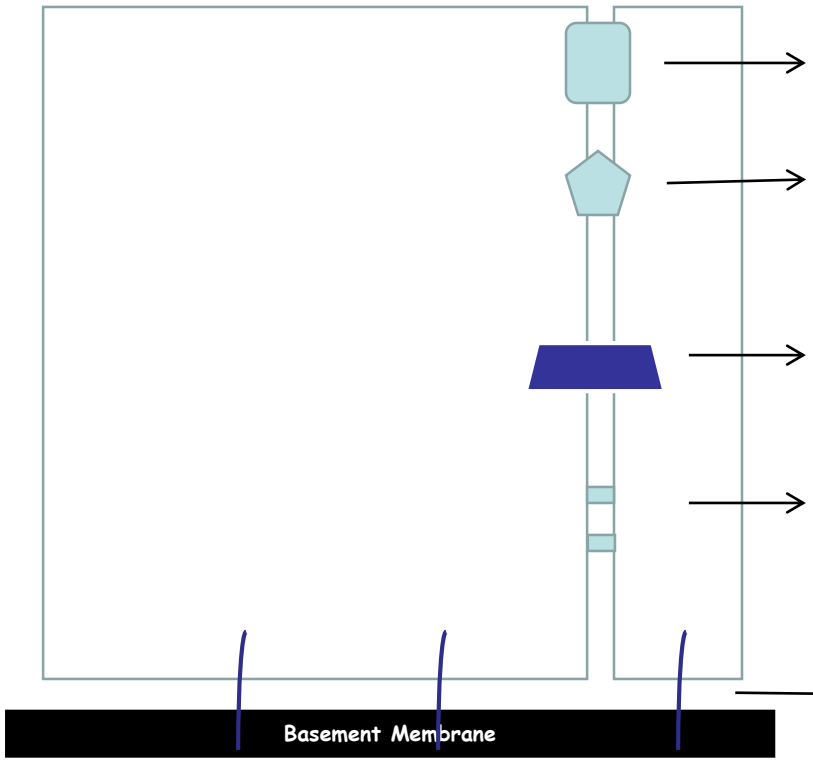
- pokrývá dlaně a plosky nohou – tzv. akrální kůže
- **hmatové lišty**
- stratum corneum - 100 vrstev buněk
- stratum granulosum – zbytnělé
- adnexa: - pouze početné ekkrinní potní žlázy



Epidermis


Stratum Corneum
Stratum Granulosum
Stratum Lucidum
Stratum Spinosum
Stratum Basale
Dermis

Epidermis – Mezibuněčné spoje



Zonula occludens: tight junctions prevent diffusion across cells

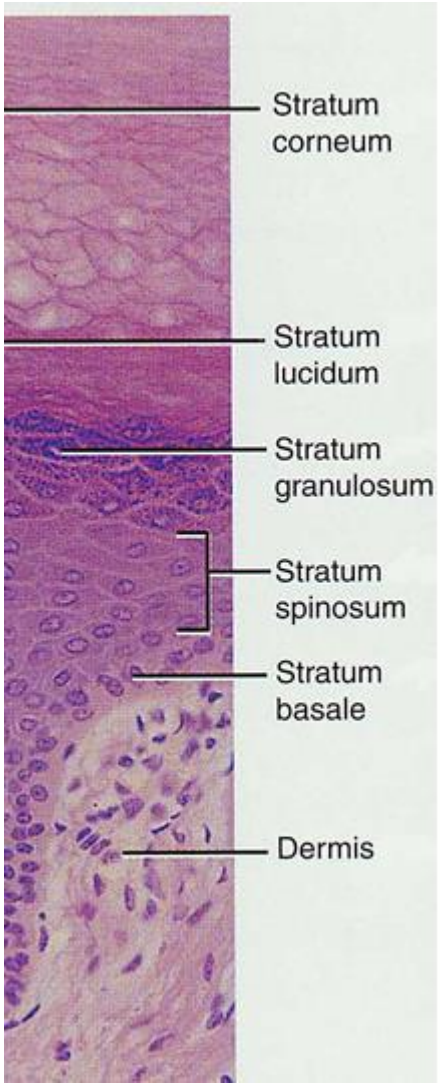
Zonula adherens: Ca++ dependent cadherins that connect to actin

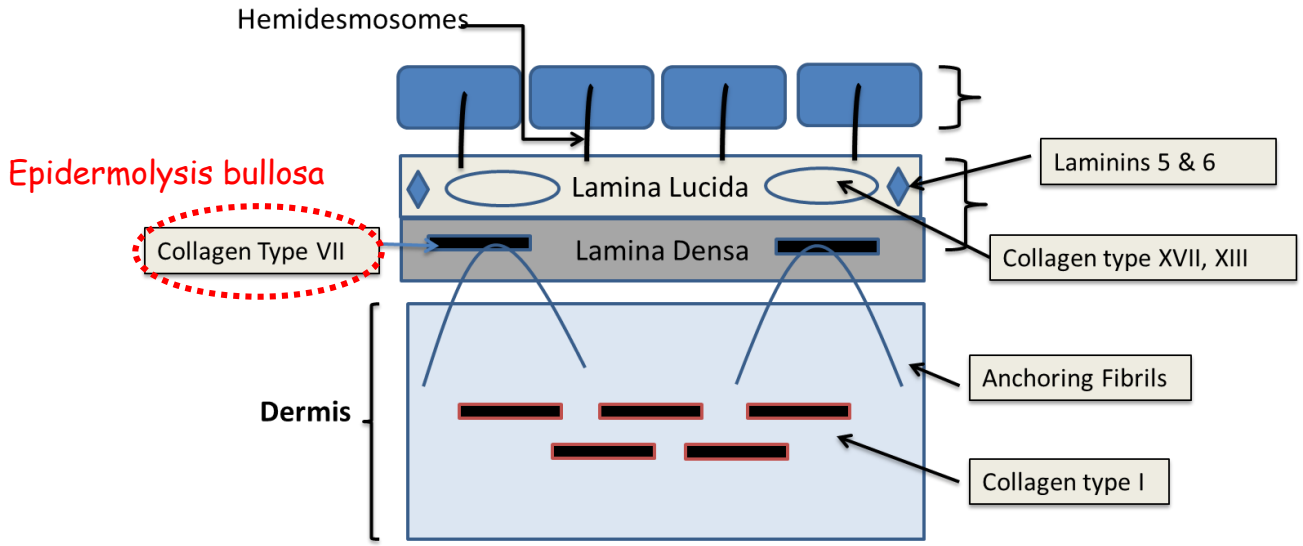
Macula adherens: made of desmosomes

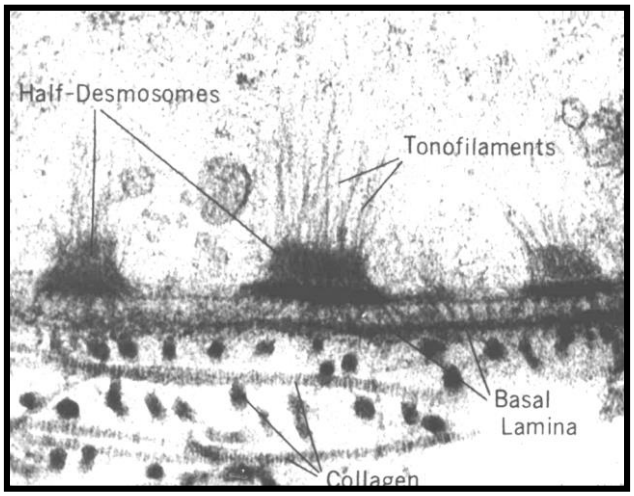
Gap junctions: communication for electric / metabolic function

Hemidesmosomes: connect cells to basal membrane

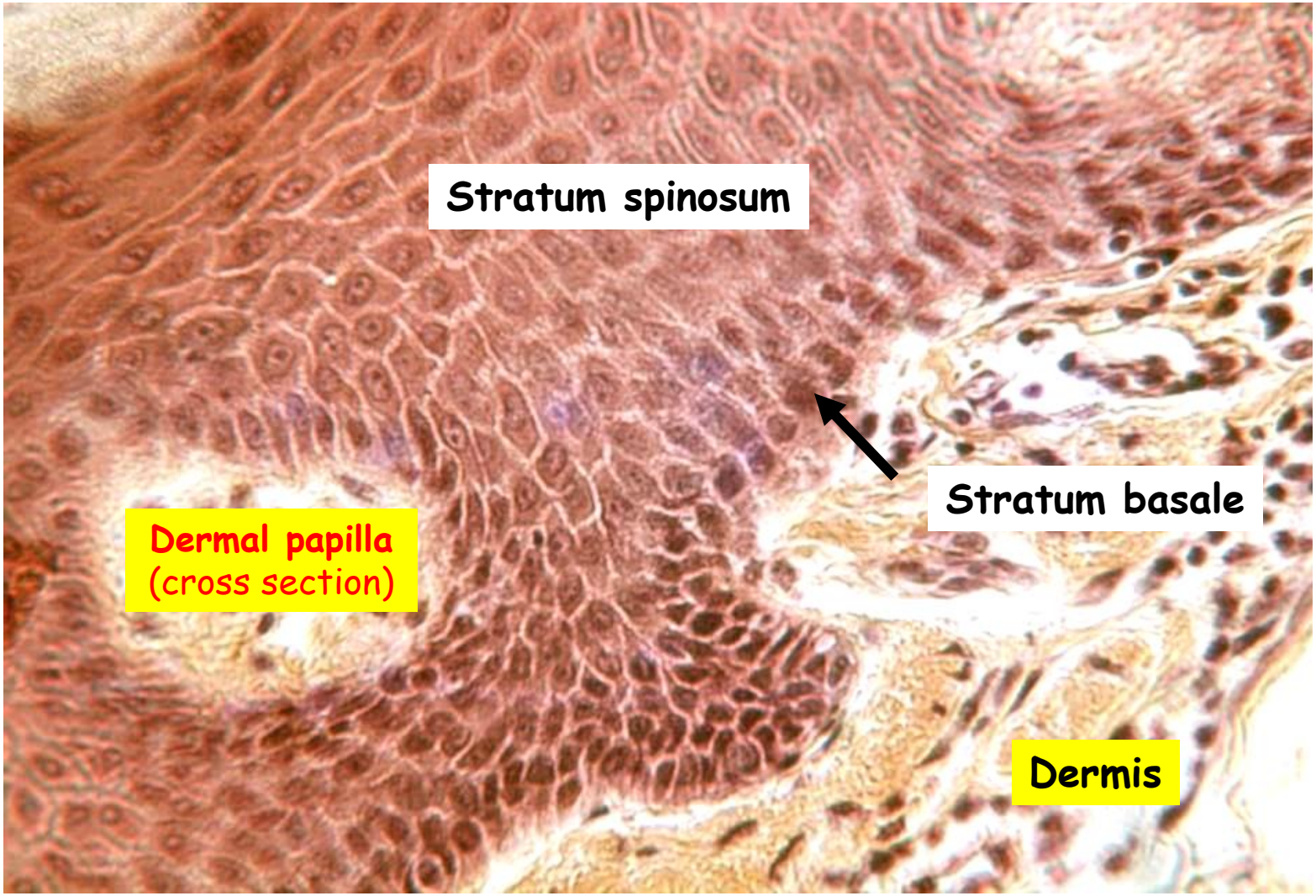
Spojení: Dermis – Epidermis
Hemidesmosomy



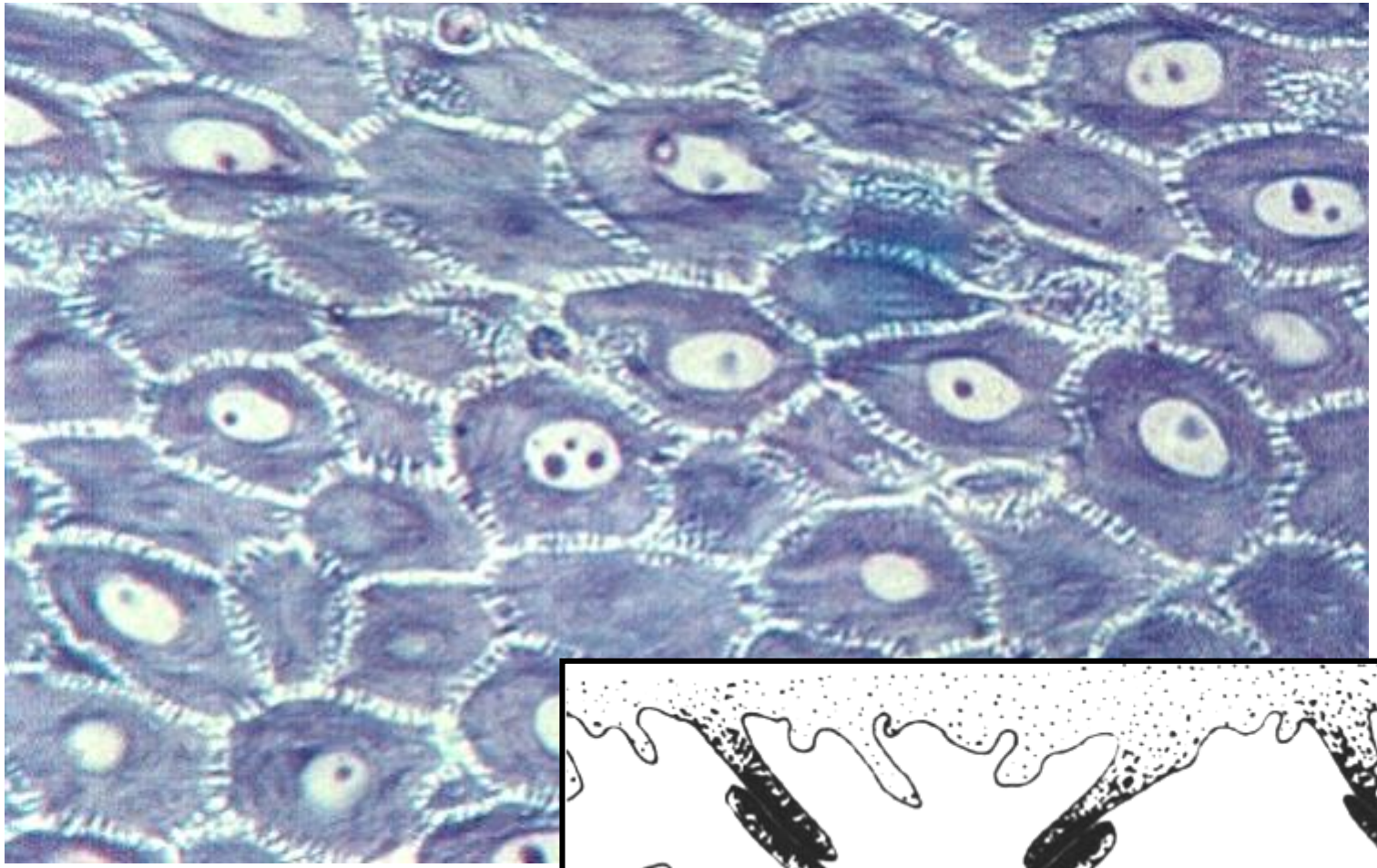




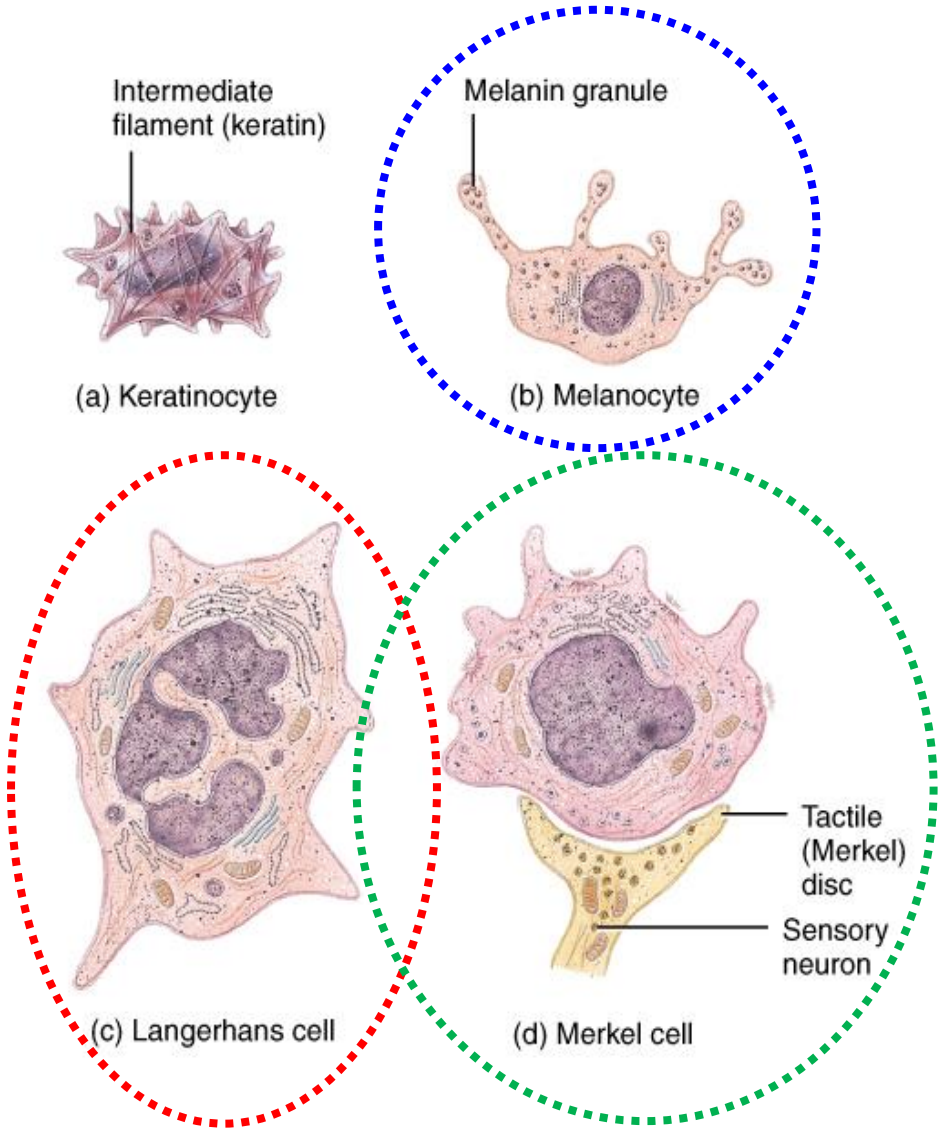
Epidermis – Stratum spinosum - Desmosomy



Epidermis – Stratum spinosum

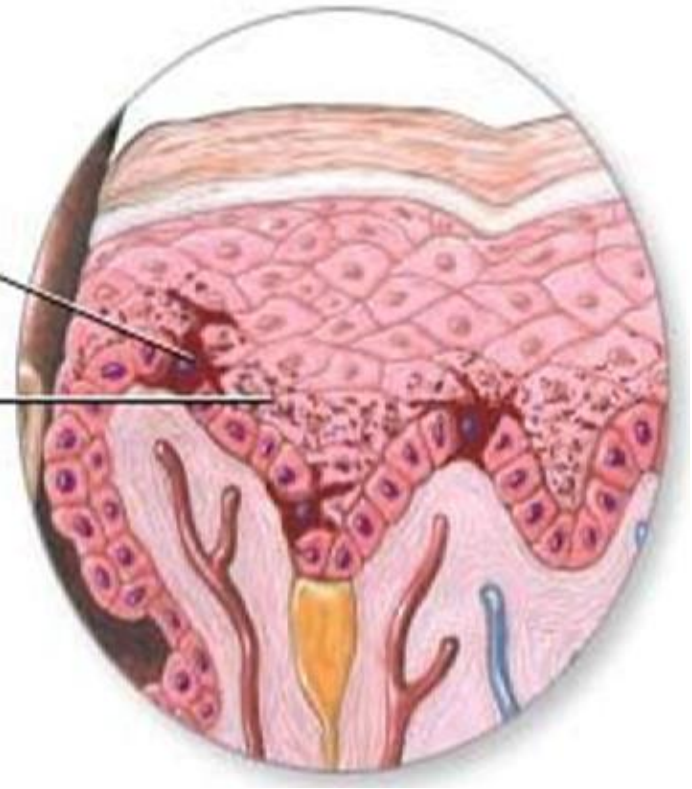


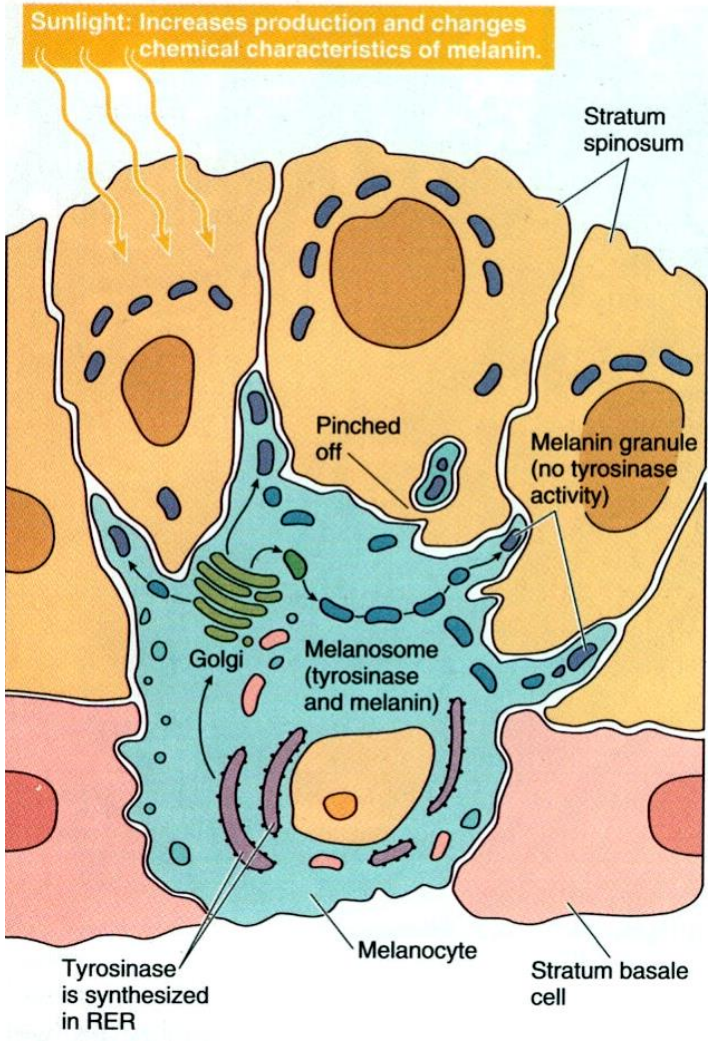
Epidermis – Nekeratinizující buňky



- **Keratinocyty** - 90%
  - produce keratin
- **Melanocyty** - 8 %
  - produces melanin pigment
  - melanin transferred to other cells with long cell processes
- **Langerhansovy buňky**
  - from bone marrow
  - provide immunity
- **Merkelovy buňky**
  - in deepest layer
  - form touch receptor with sensory neuron

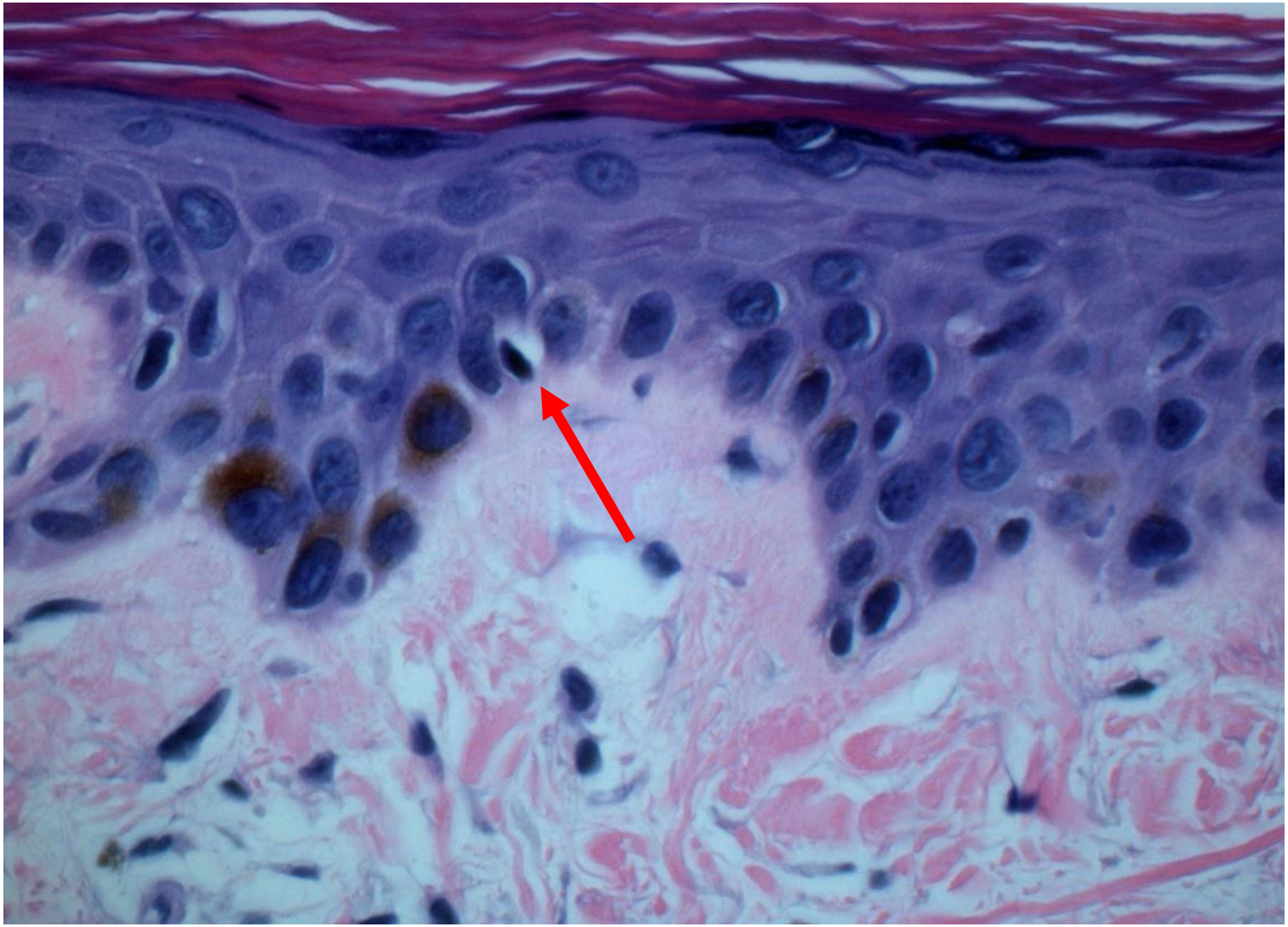
Epidermis – Melanocyty 1





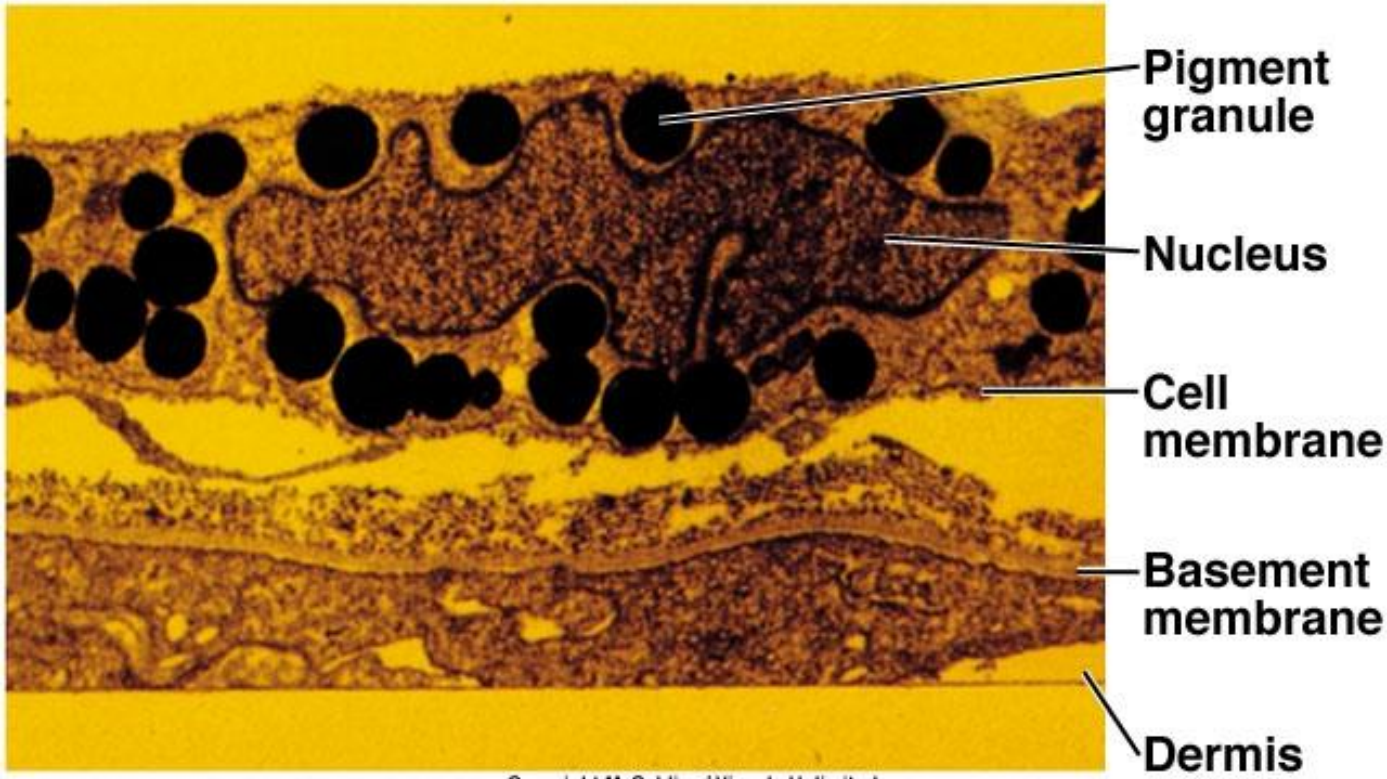
Melanocytes: clearish cells in basal layer with dark nuclei ; ratio of 1 : 40 – epidermo-melaninová jednotka

Epidermis – Melanocyty 2



Epidermis – Melanocyty 3

Melanocyte with Pigment Granules



Epidermis – Melanocyty 4 - Pigmenty

Three pigments contribute to skin color

Melanin – yellow to reddish-brown to black pigment, responsible for dark skin colors

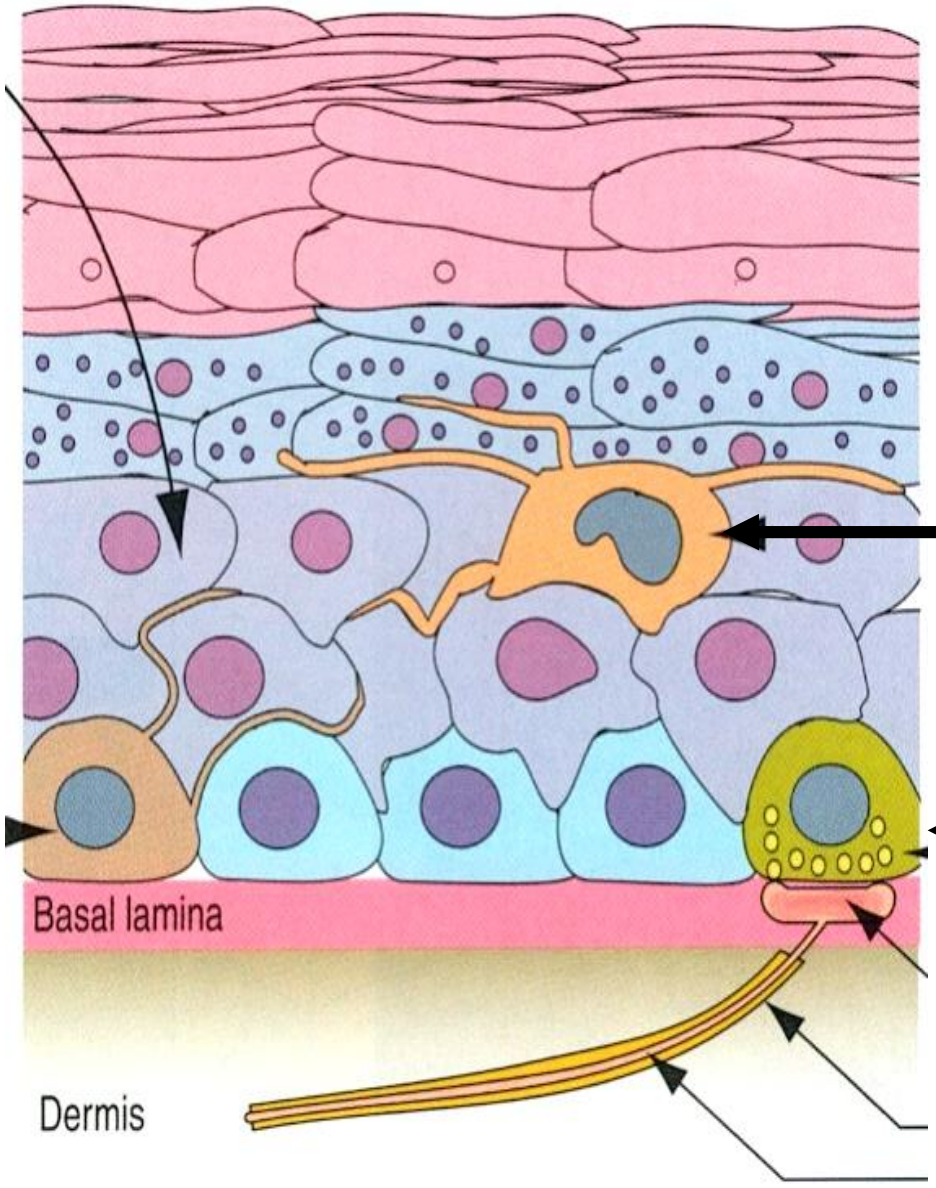
(Freckles and pigmented moles – result from local accumulations of melanin)

Carotene – yellow to orange pigment, most obvious in the palms and soles of the feet

Hemoglobin – reddish pigment responsible for the pinkish hue of the skin

Do some people have more melanocytes than other people?
NO !!!!

Epidermis – Langerhansovy + Merkelovy buňky



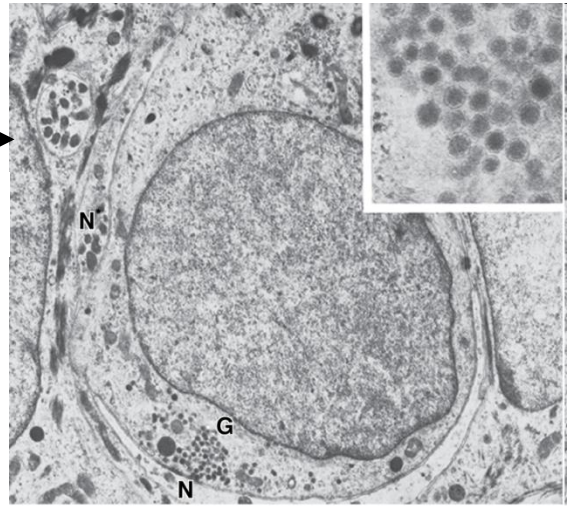
Migrate to lymph nodes

Langerhans cell

immunological reaction that effects the skin and may serve defense mechanism_for the body

Merkel cell

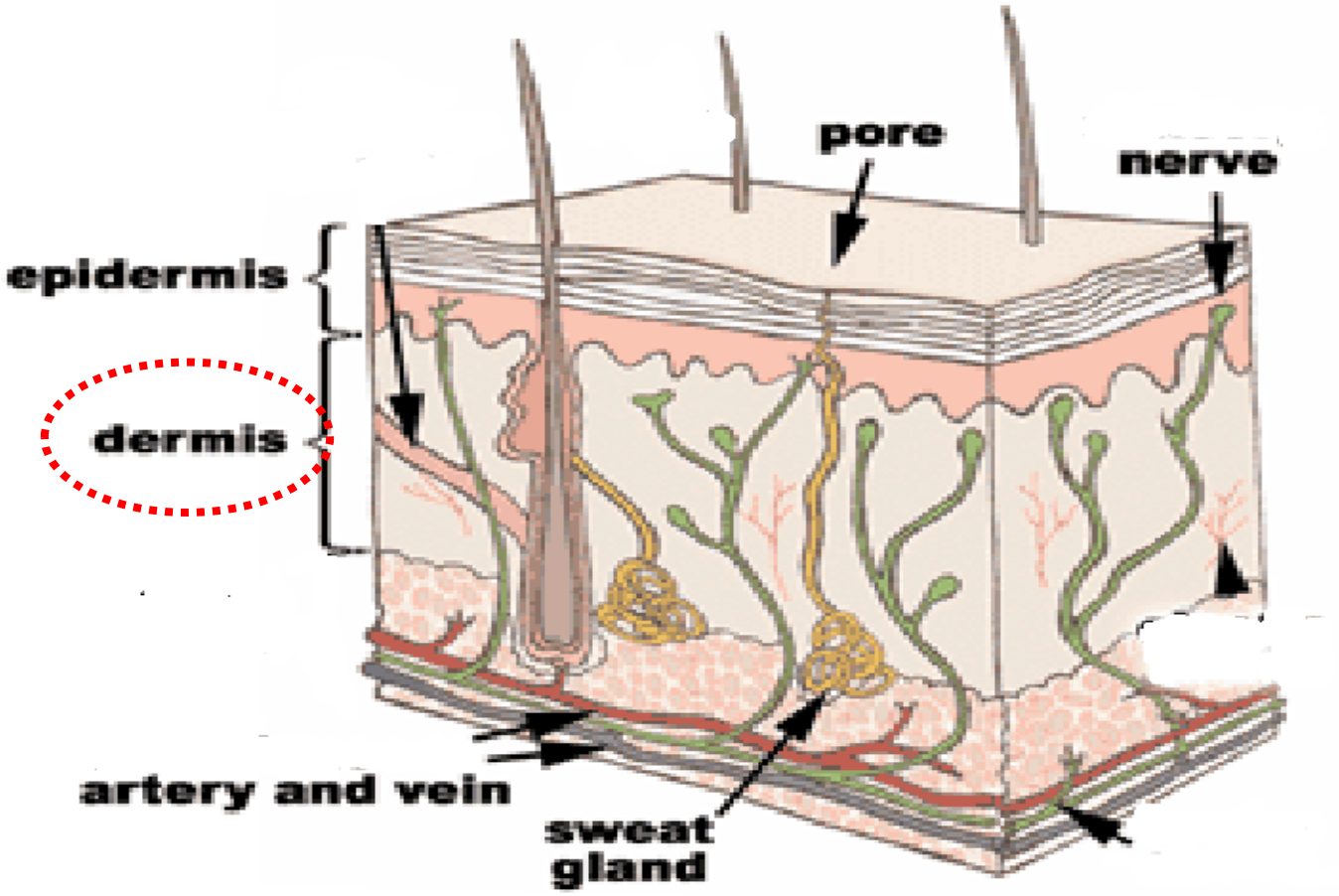
combines with disclike sensory nerve endings to make Merkel's discs



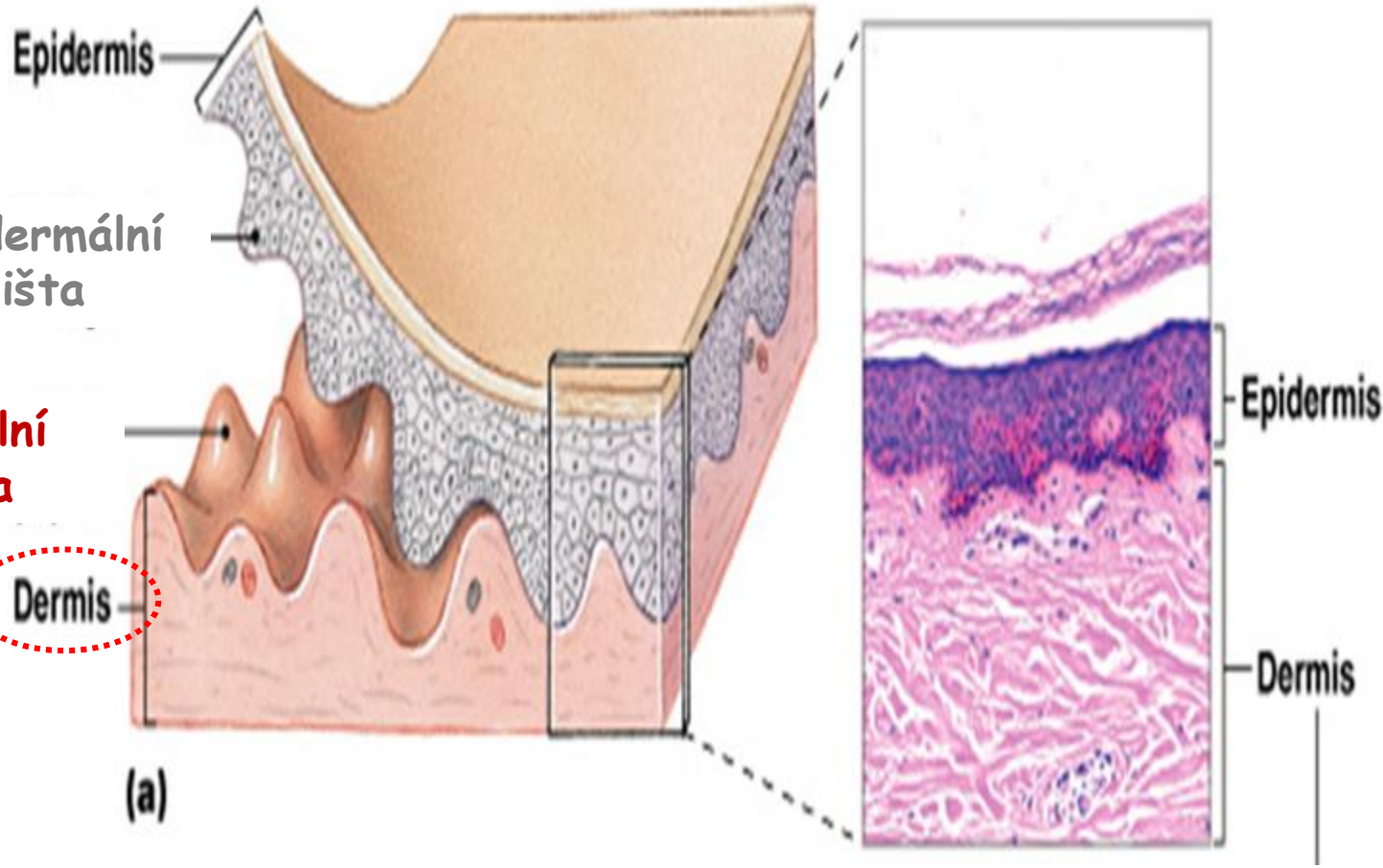
Dermis (škára) 1

Everything below the dermal-epidermal junction / basement membrane

Connective tissue layer with contains blood vessels, nerves, sensory receptors, adnexal structures



Dermis 2

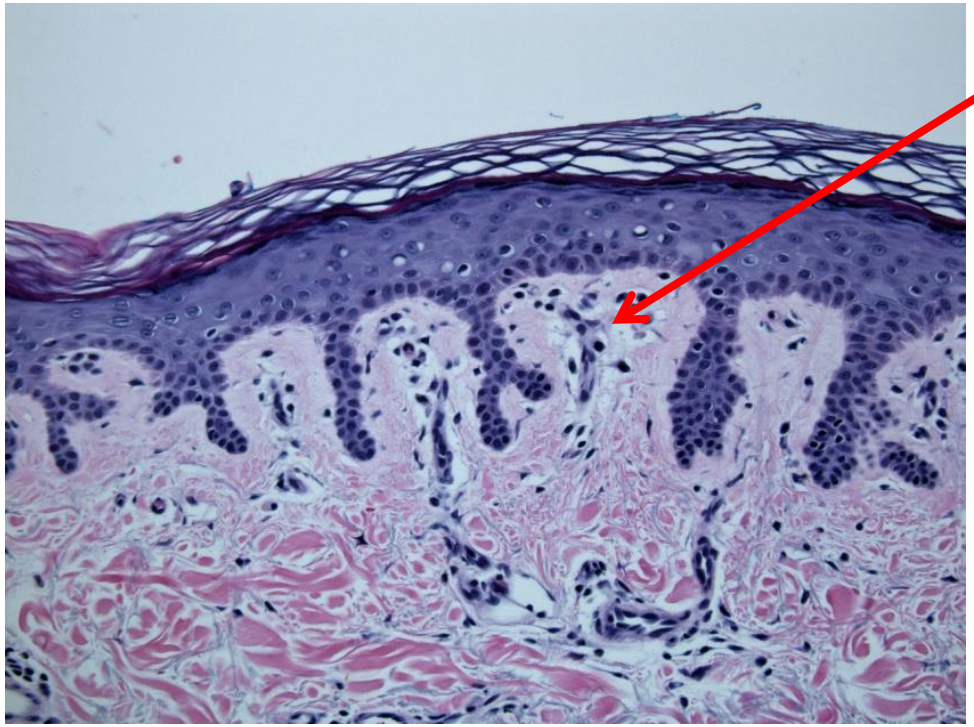


Stratum papillare
(tenké)

Stratum reticulare
(tlusté)

= **až 4 mm na dlaních a ploskách nohy**

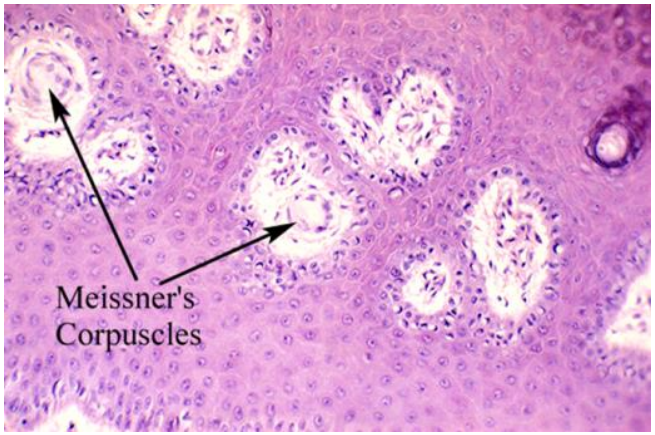
Stratum papillare 1



Capillaries

Str. papillare

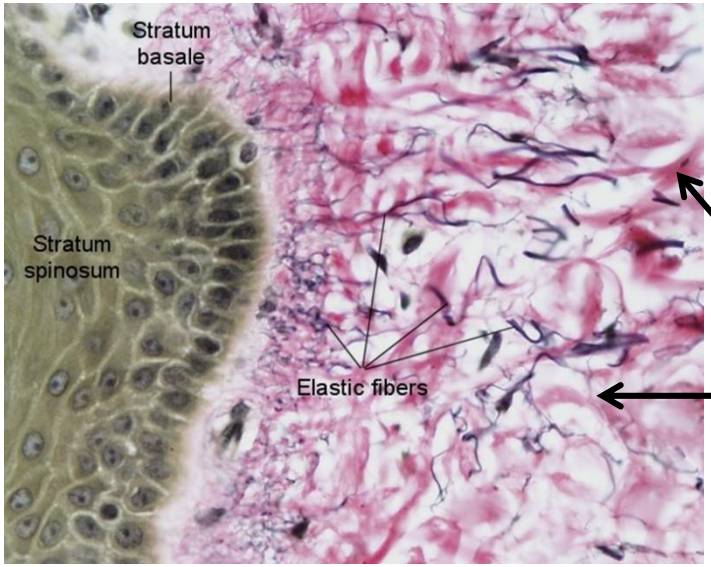
- **Řídké vazivo** & elastická vlákna
- **dermal papillae** which project into epidermis
- anchors epidermis to dermis
- contains **Meissnerova hmatová tělíska** (tlak) & **volná nervová zakončení** (bolest & teplota)



Stratum papillare 2

Two major types of fibers:

- Type I Collagen
- Elastic fibers: three types based on microfiber and elastin content

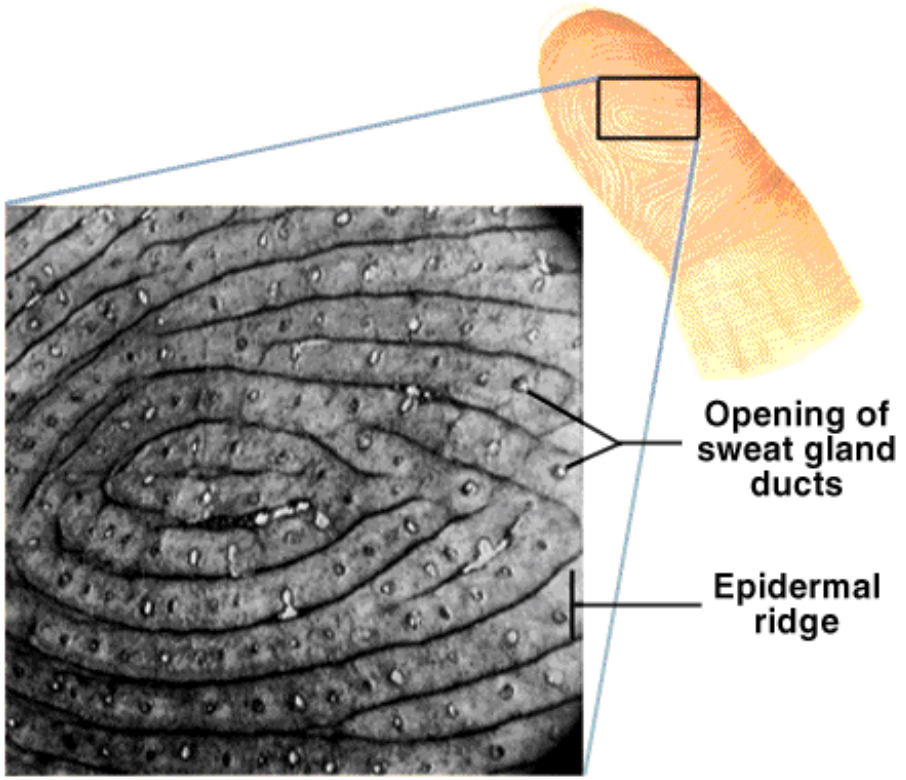


Type I Collagen

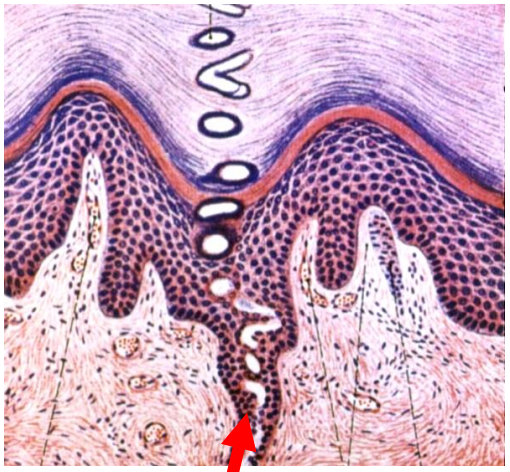
Stratum papillare 3

Epidermalální lišty (dlaně + plosky)

- reflect contours of the underlying dermal papillae
- form the basis for fingerprints (and footprints)
- increase firmness of grip by increasing friction
- Daktyloskopie - the study of the pattern of epidermal ridges

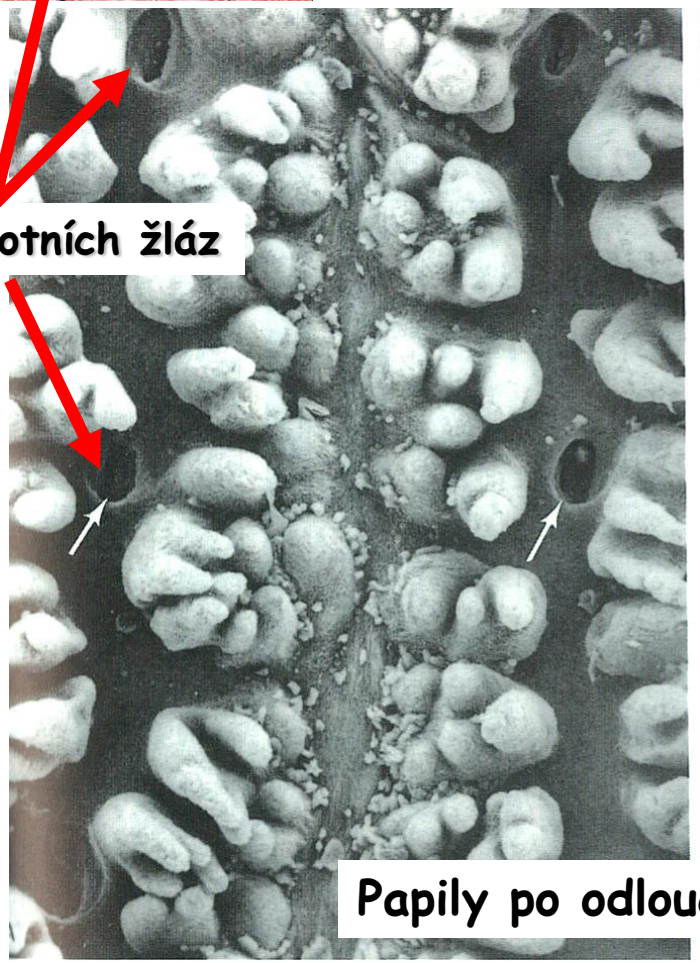


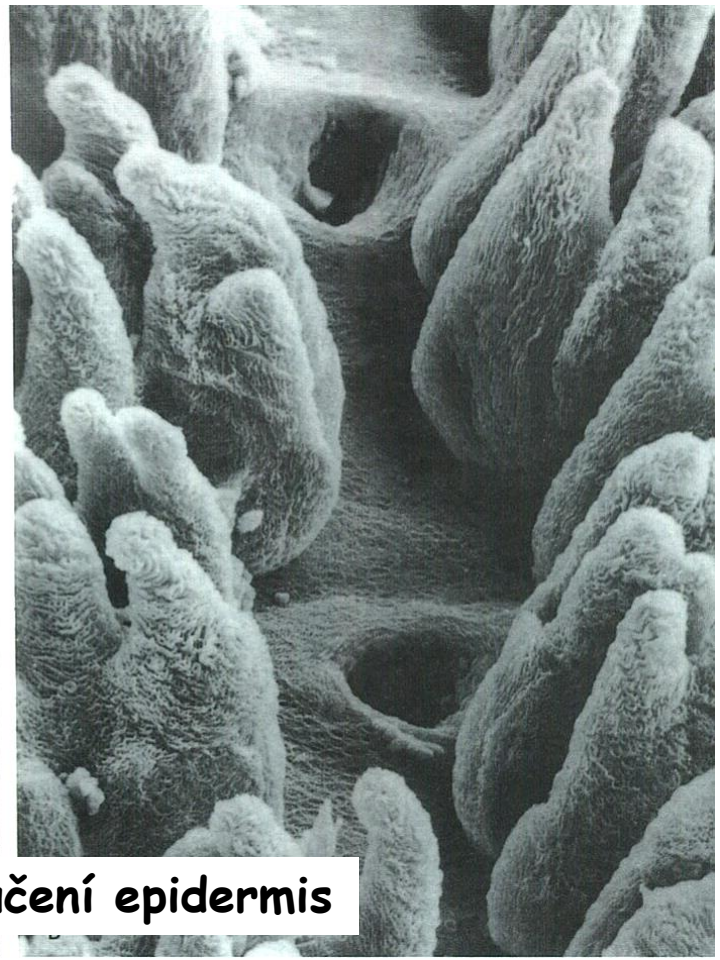
Stratum papillare 4



Dermální papily

Vyústění potních žláz

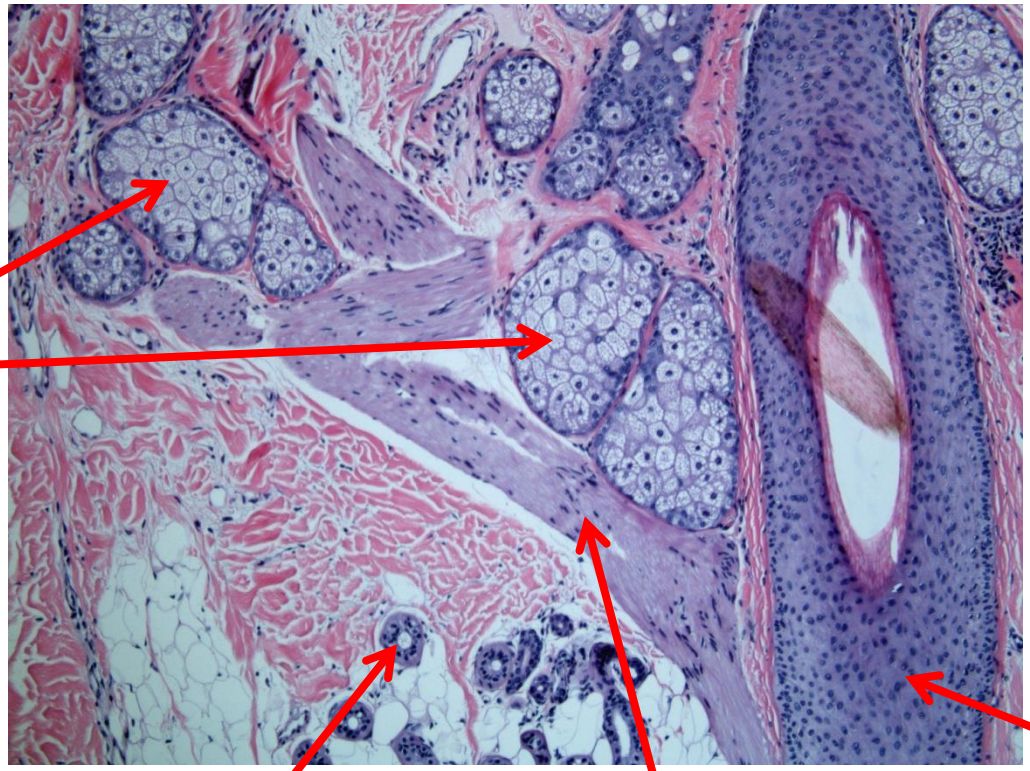




Papily po odloučení epidermis

Stratum reticulare + Kožní adnexa

- **Husté nepravidelně organizované vazivo**
- **Mazové žlázy**
- **Vlasové folikuly**
- Ducts of **sweat** (sudoriferous) **glands**
- **Linie štěpnosti**
- **Meissner's corpuscles** and **Pacinian corpuscles** (on lips, ext. genitalia, nipples)



Kožní žlázy

Potní	Ekkrinní	Tubulózní
	Apokrinní (ekkrinní)	Tubulózní až tubuloalveolární
Mazové	Holokrinní	Větvené acinózní (alveolární)

Kožní žlázy – Ekkrinní potní žlázy
(glandulae sudoriferae eccrinae)

- **Sekreční oddíl:**

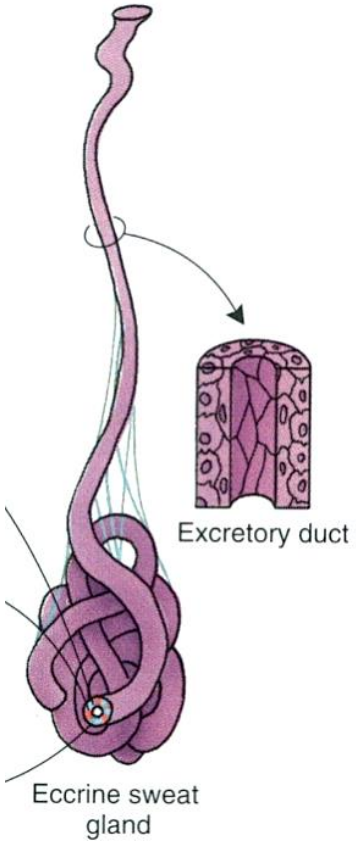
Jednovrstvý cylindrický epitel + myoepitelové buňky

- **Vývodní oddíl:**

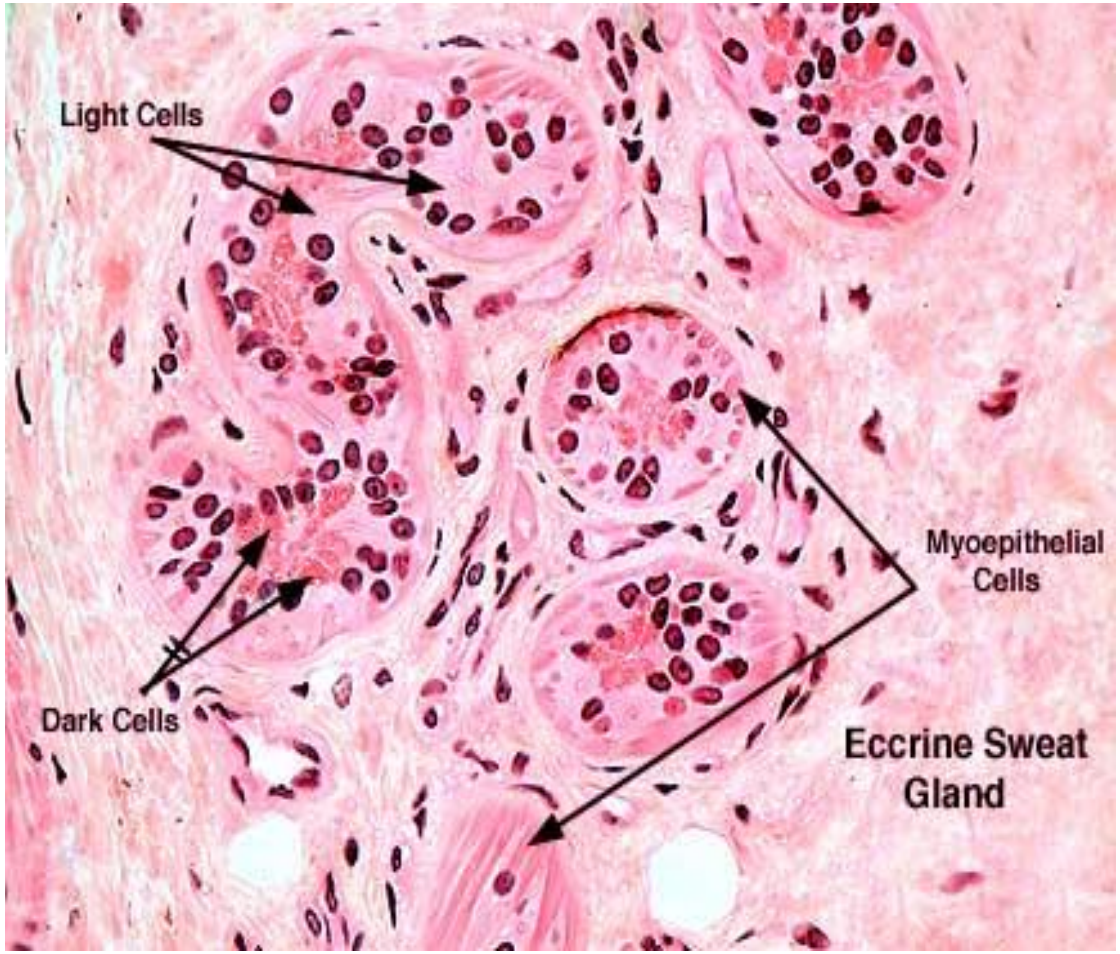
Dvouvrstvý kubický epitel

Release to adjust body temperature

Not on: red lips, glans penis, preputium, labia minora



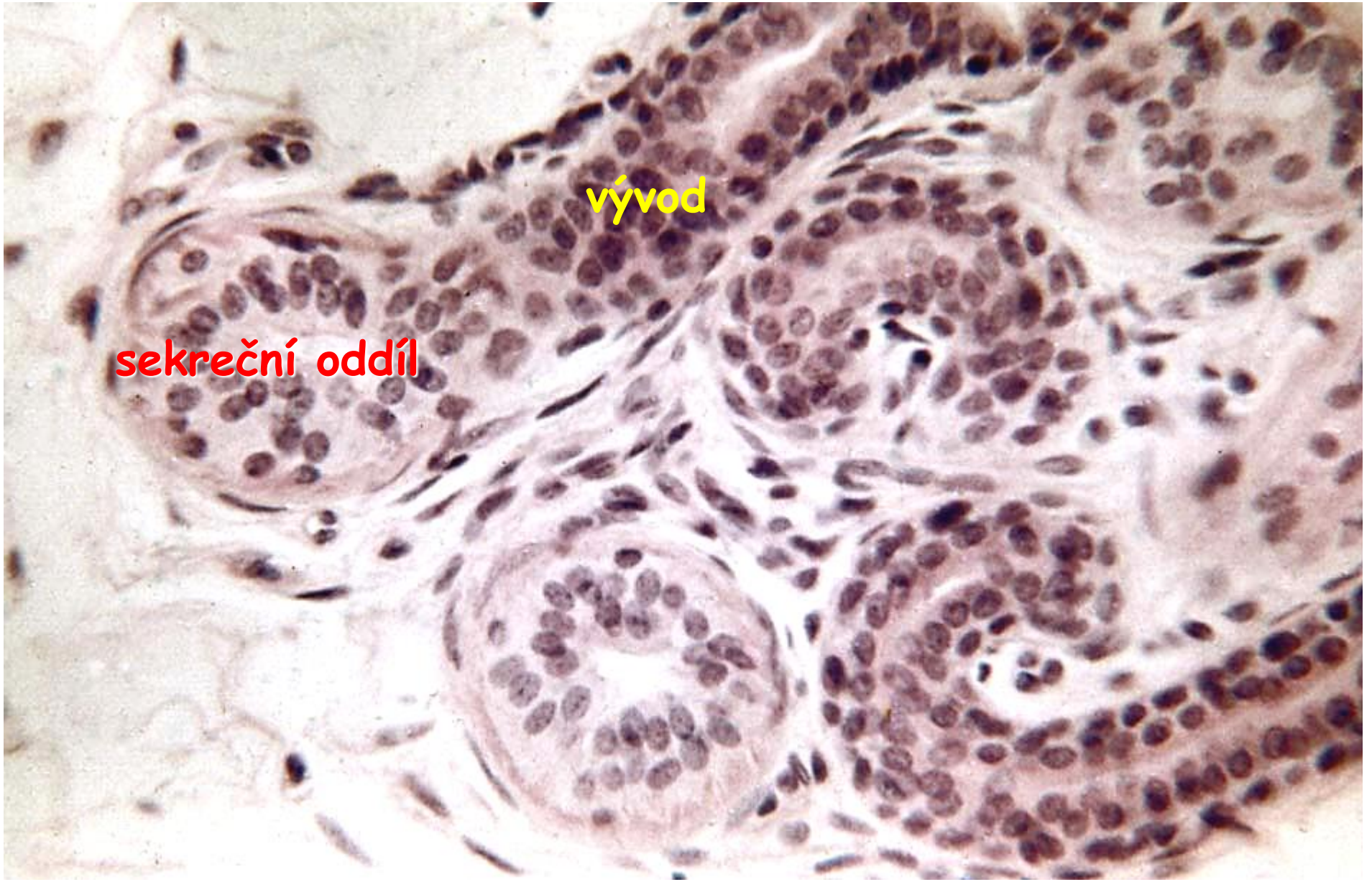
Ekkrinní potní žlázy



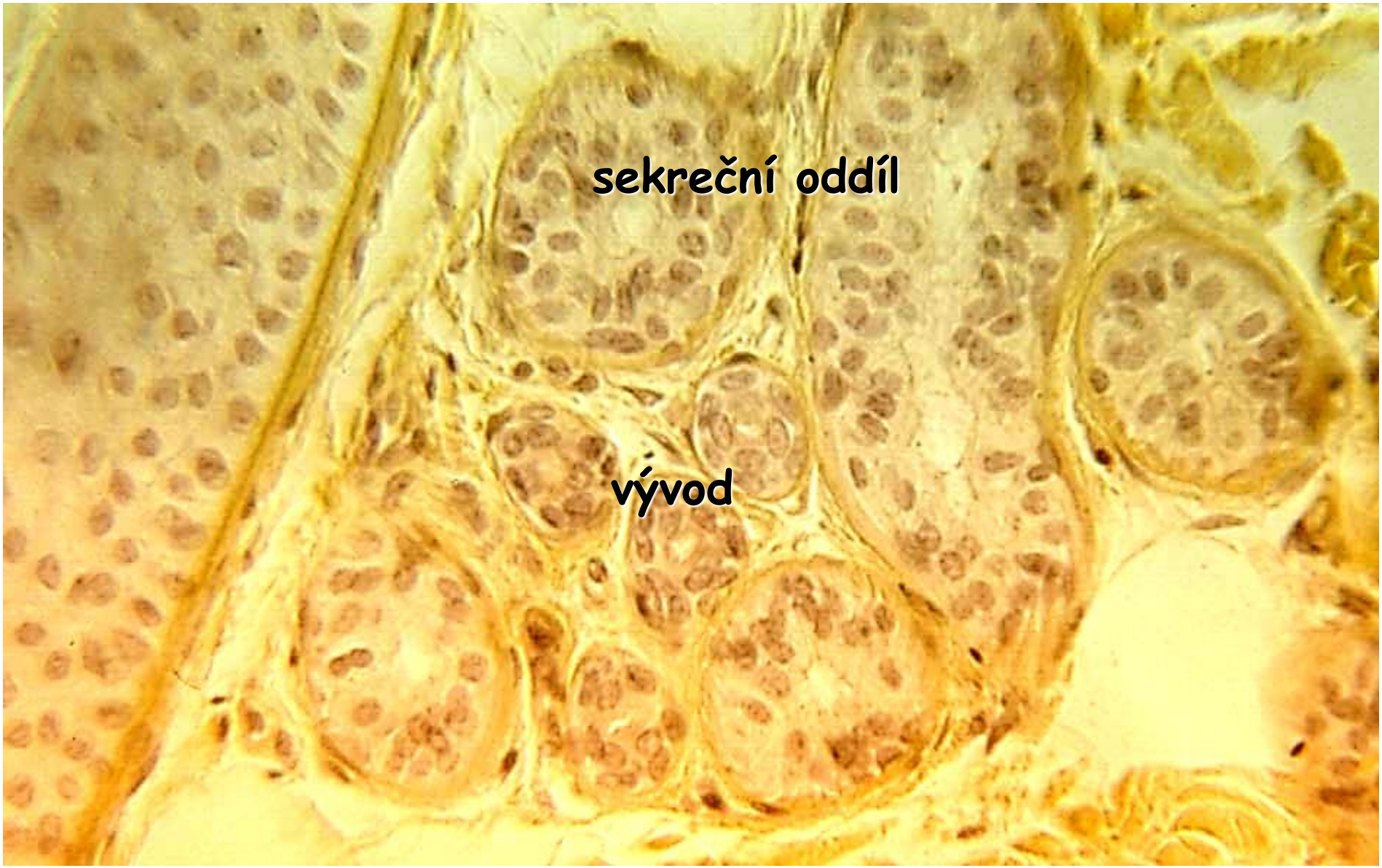
Three cell types

- **Dark cells**: pyramid shaped with secretory granules line lumen of tubule
- **Clear cells**: located toward basement membrane – secrete water and ions
- **Myoepithelial cells**: spindle shaped contractile cells

Ekkrinní potní žlázy



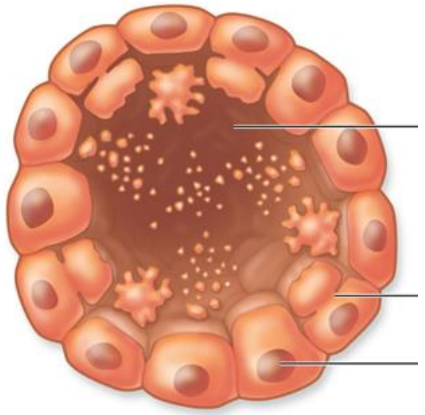
Ekkrinní potní žlázy



Kožní žlázy – Apokrinní potní žlázy
(glandulae sudoriferae apocrinae)

- **Sekreční oddíl:**

Jednovrstvý dlaždicový až cylindrický epitel
(v závislosti na obsahu produktu) + myoepitelové buňky



c Apocrine gland

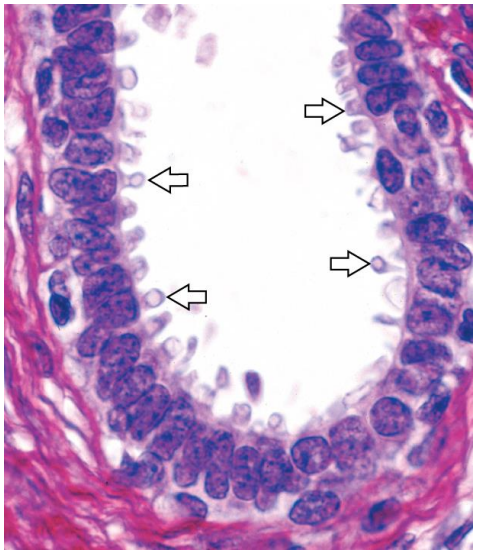
- **Vývodní oddíl:**

Dvouvrstvý kubický epitel

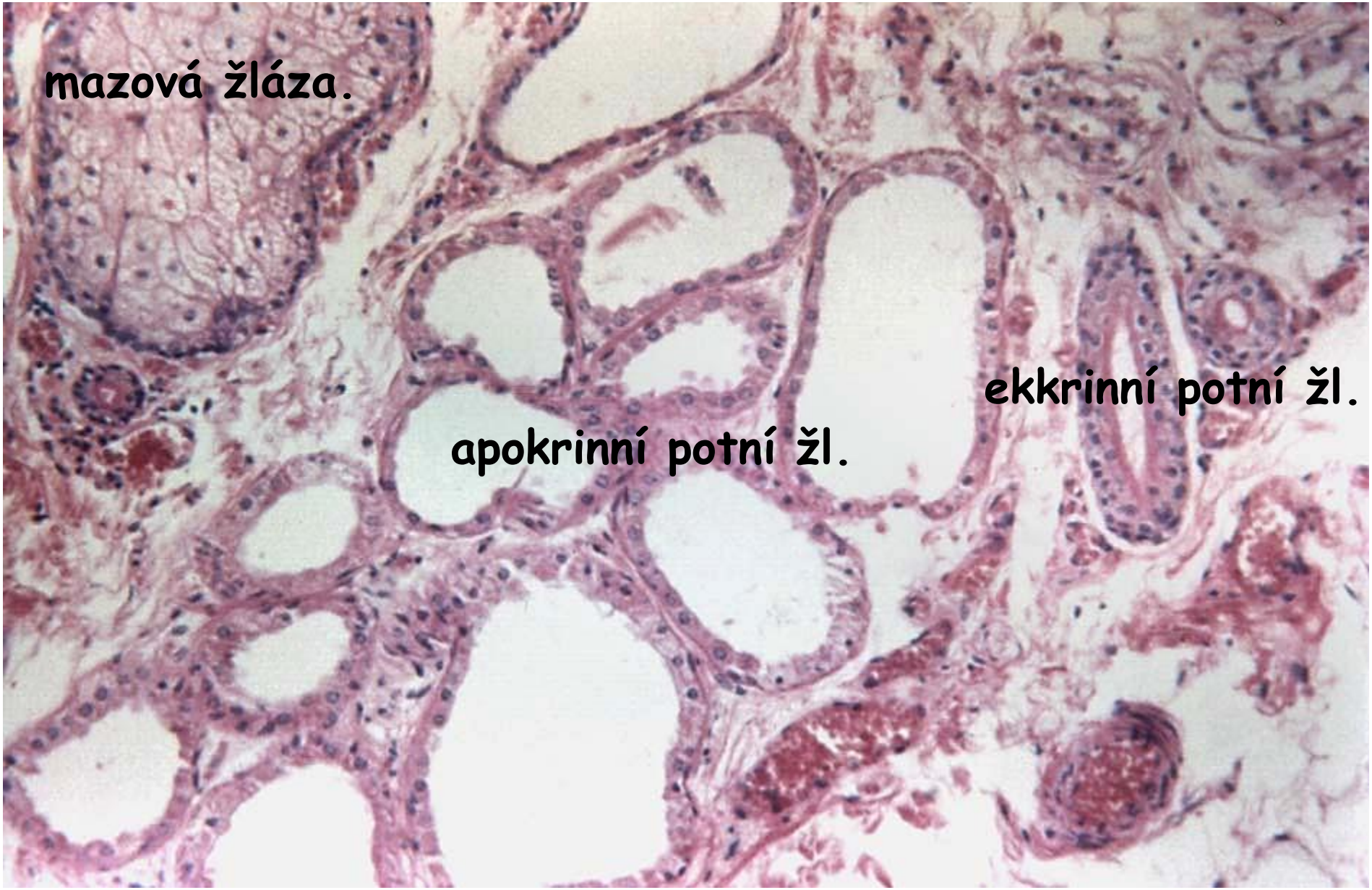
Vždy asociovány s vlasovým folikulem !!!

Řízeny hormonálně (**aromatické žlázy**)

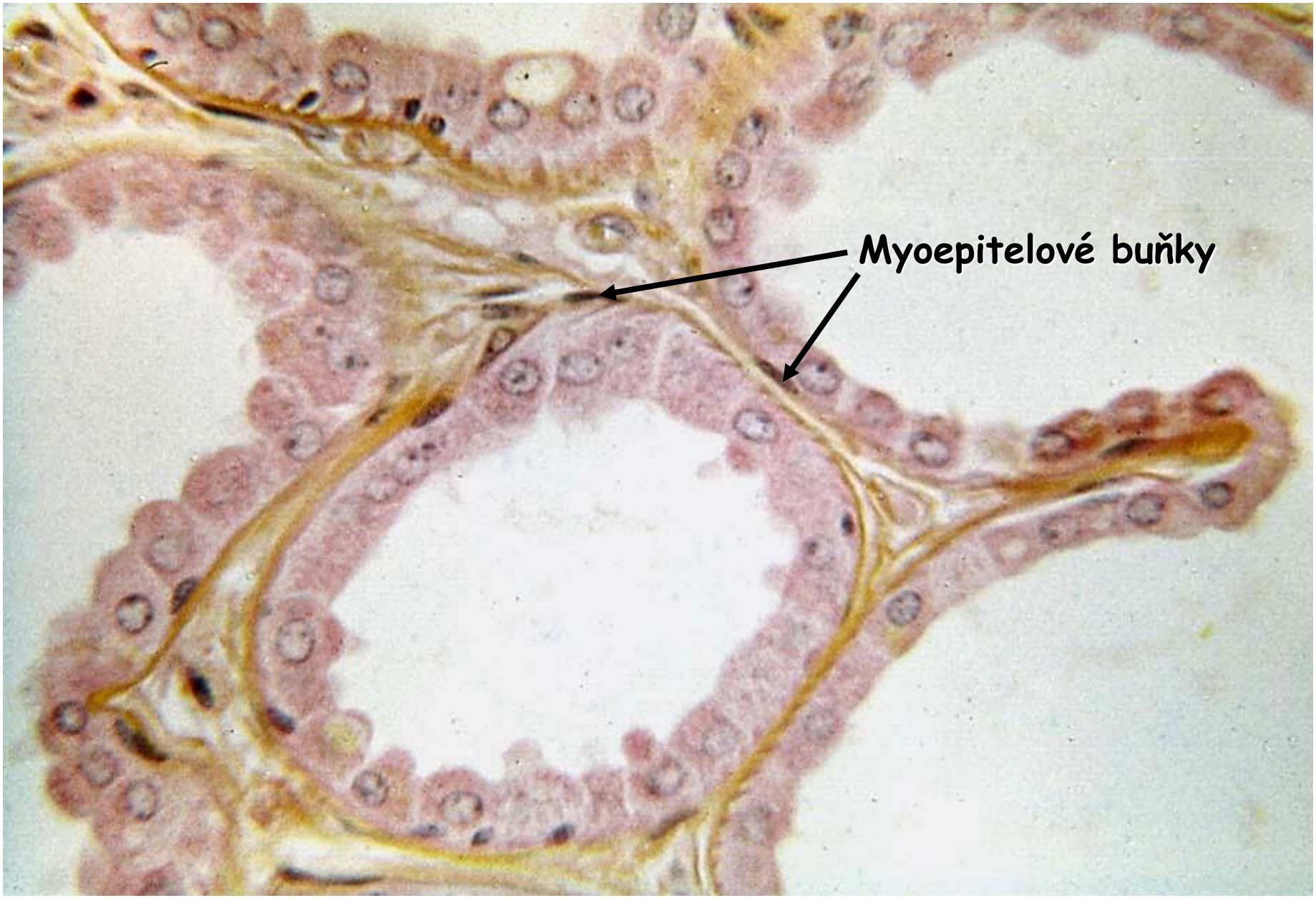
Pouze na: podpaždí, dvorec prsu, scrotum, labia maiora, perianální oblast, zevní zvukovod, eye lid *(Mollovy žlázy)*



Apokrinní potní žlázy

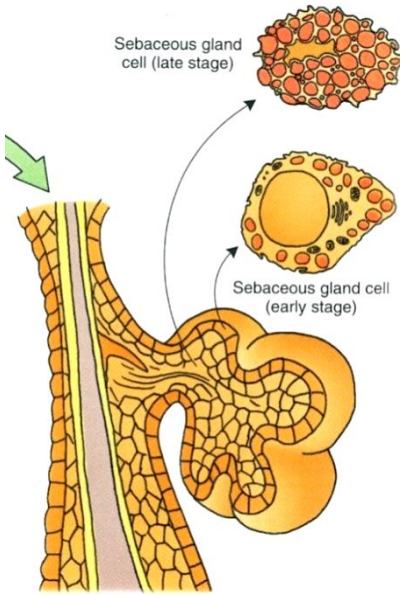


Apokrinní potní žlázy



Kožní žlázy – Mazové žlázy
(glandulae sebaceae)

Jendoduché větvené acinární žlázy
Několik acinů ústí do jednoho vývodu.



- **Sekreční oddíl:**

Vícevrstvý epitel, postupně degeneruje

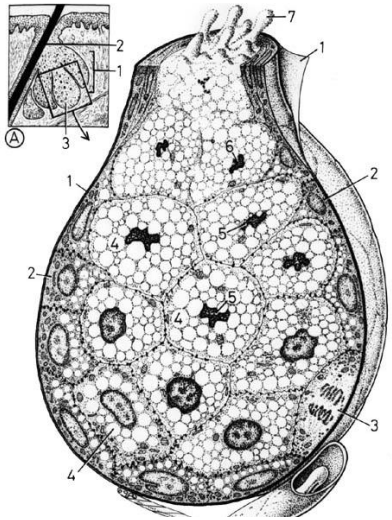
- **Vývodní oddíl:**

Vícevrstvý dlaždicový epitel

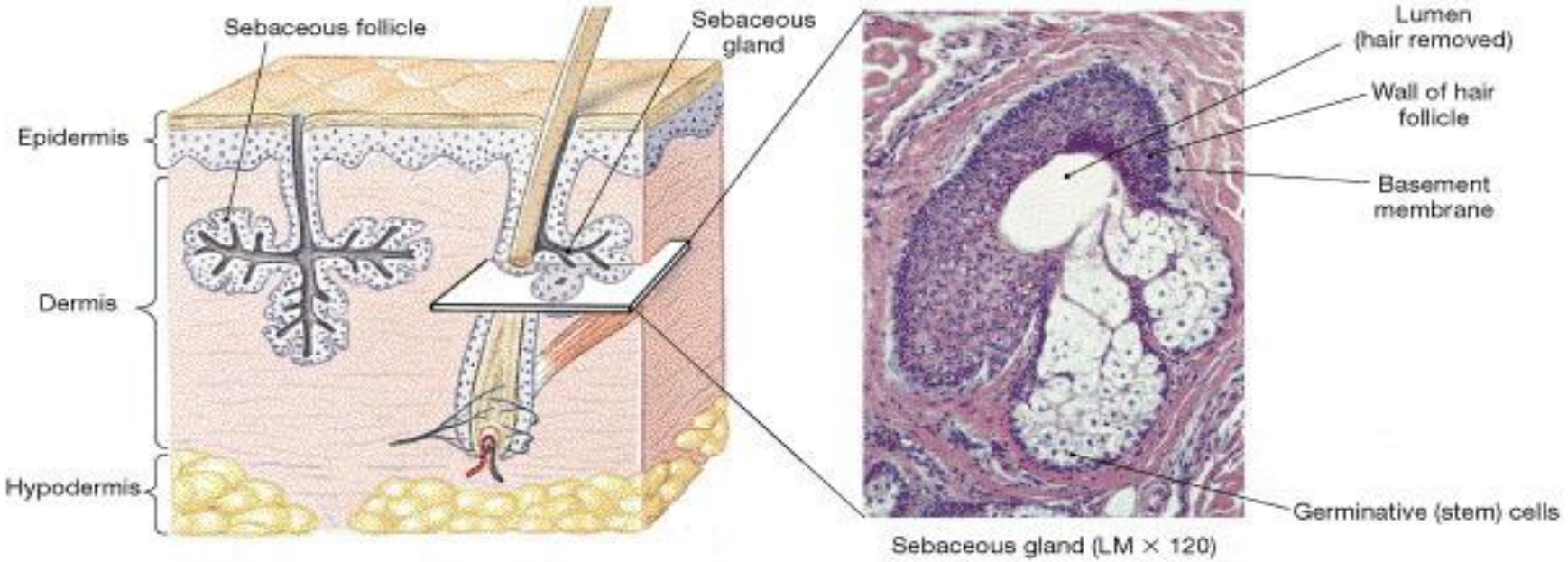
Obvykle asociovány s vlasovým folikulem

Volně: červeň rtů, glans penis, preputium, labia minora, oční víčko *(Meibomovy žlázy)*

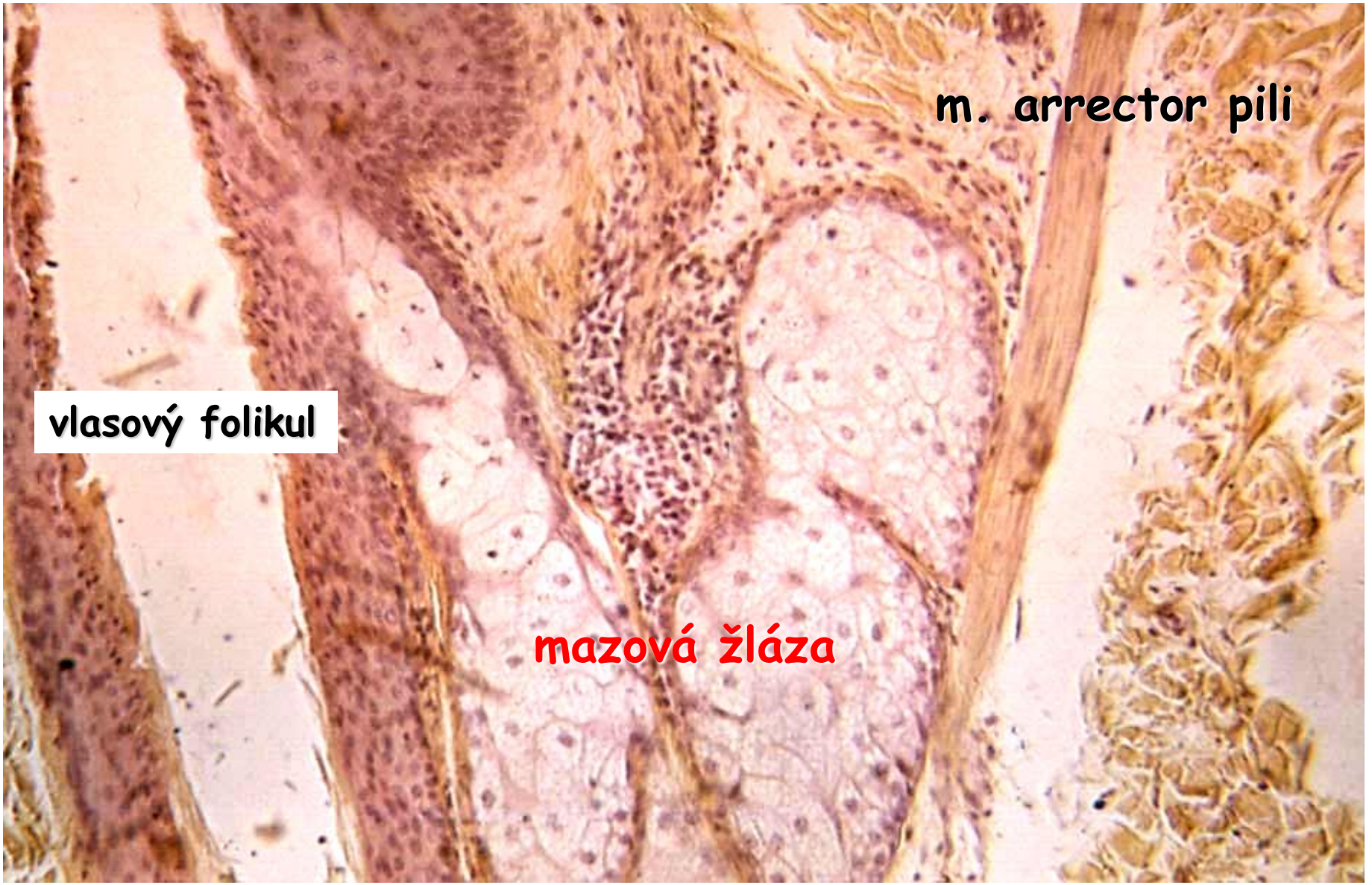
Nejsou na: dlaních a ploskách nohy



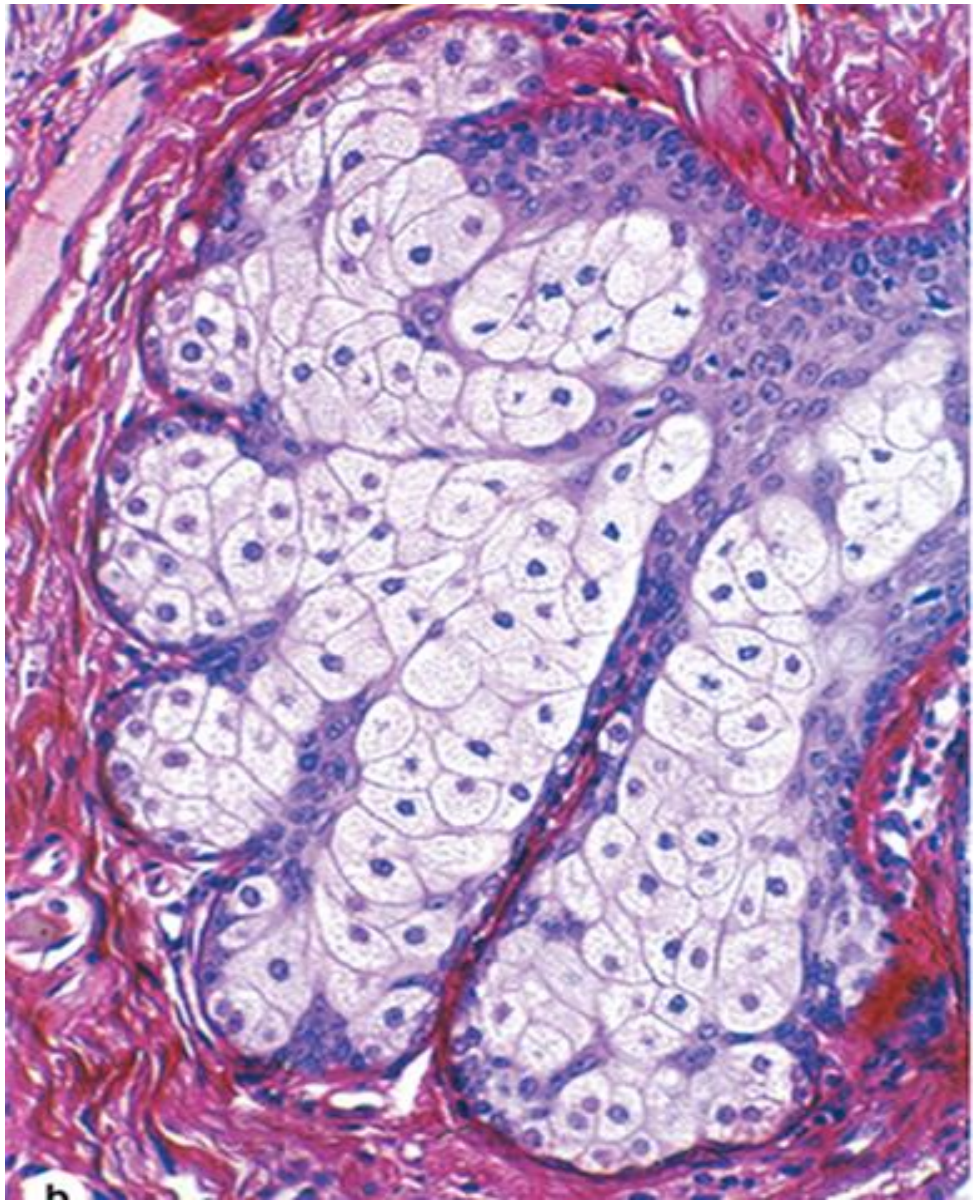
Mazové žlázy

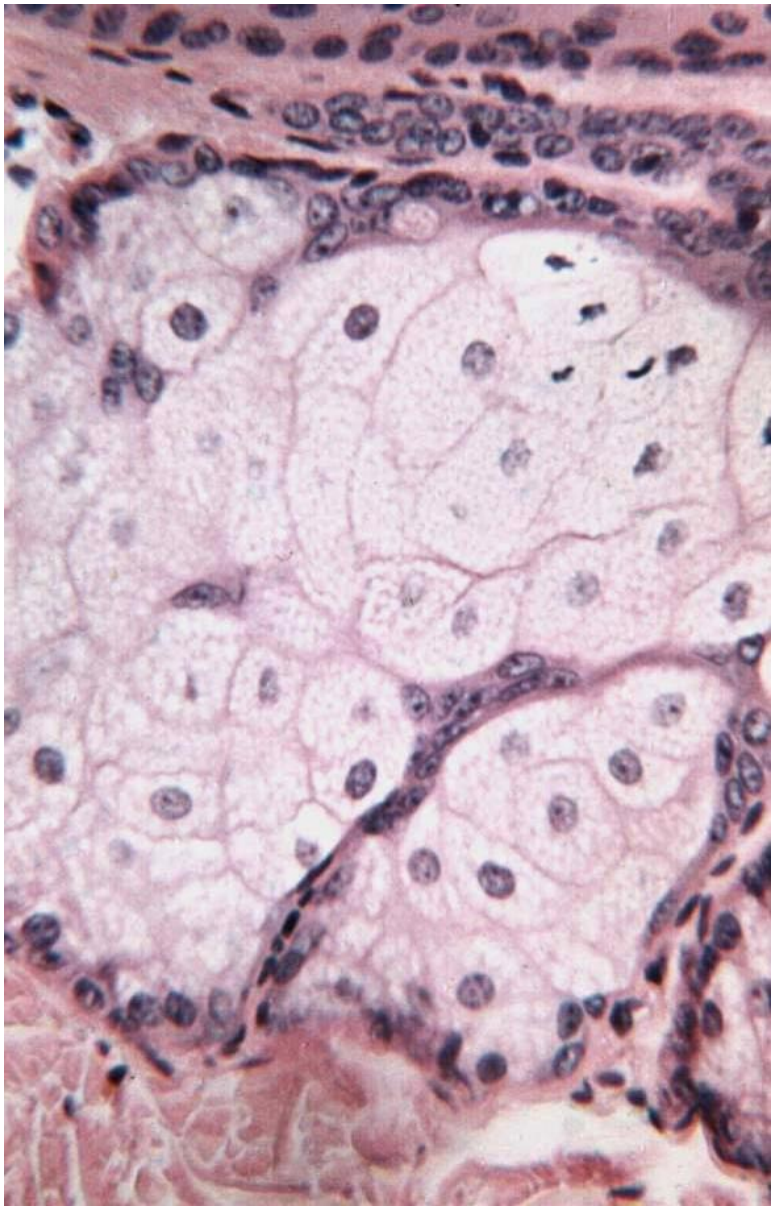


Mazové žlázy



Mazové žlázy



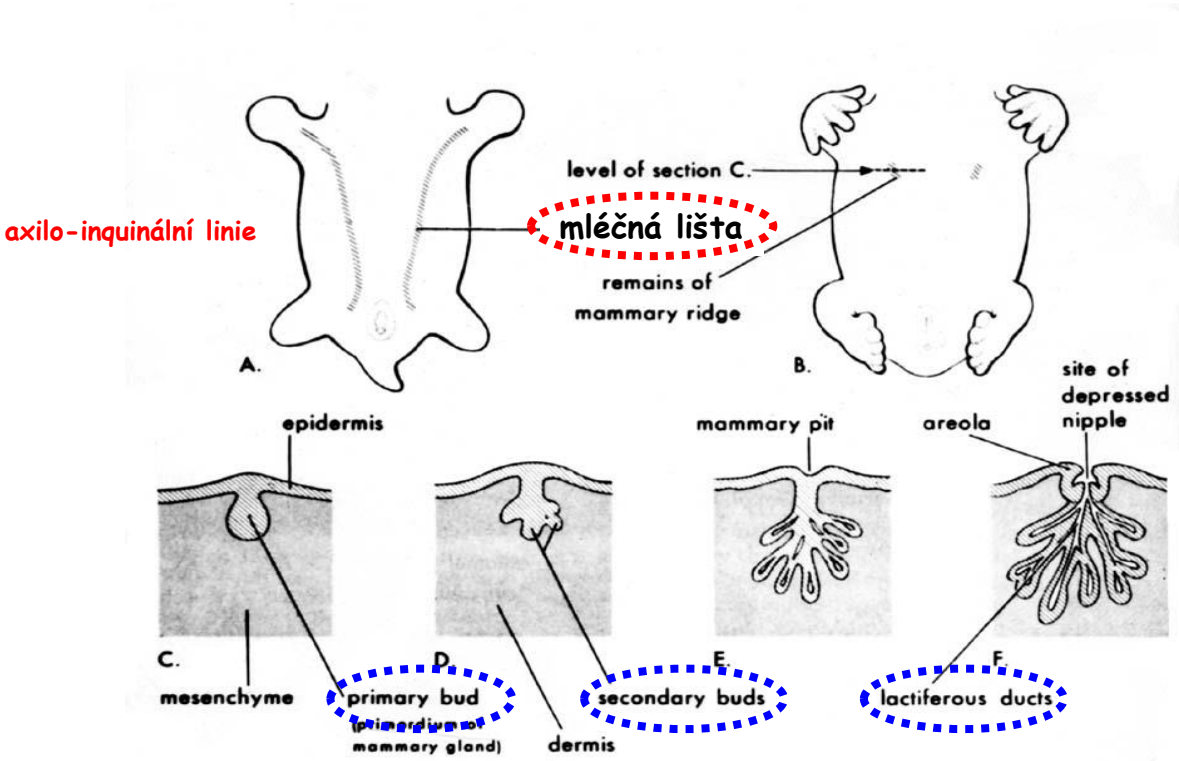


Mléčná žláza

Modifikovaná a specializované tuboalveolární potní žláza.

Parenchym
- Vývody
- Ektoderm povrchu těla (od šestého týdne)

Stroma
- Pojivová tkáň
- Mezenchymový původ

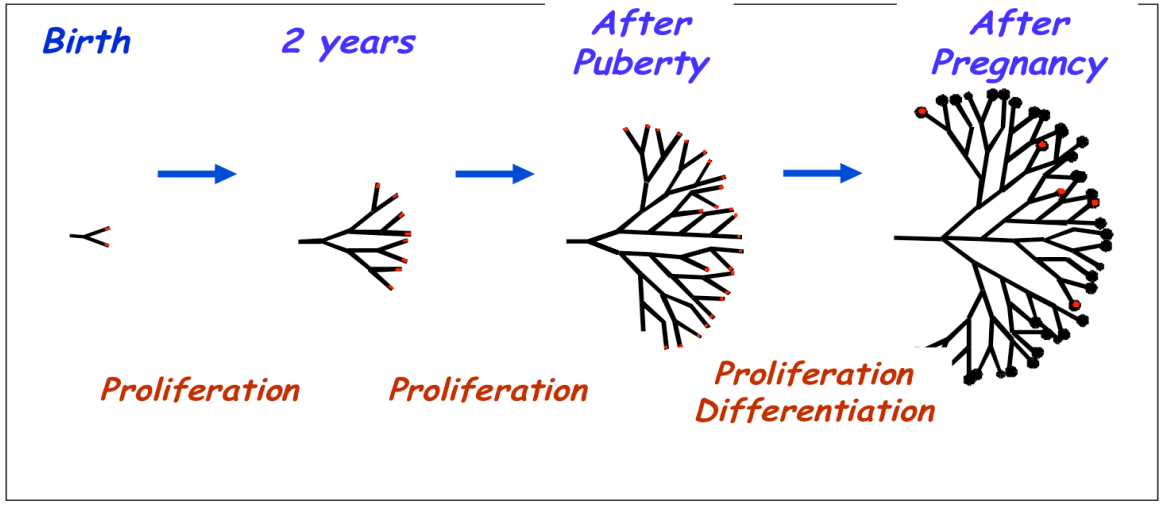


Nadpočetné mléčné žlázy a bradavky

- An extra breast (**polymastia**) or nipple (**polythelia**) occurs in approximately 1% of the female population - inheritable.
- **Supernumerary nipples** are also relatively common **in males**.
- Less commonly, **supernumerary breasts** or nipples appear in the axillary or abdominal regions of females developing from extra mammary buds that develop along the mammary crests. They become more obvious in women when pregnancy occurs.

Vývoj duktálního stromu mléčné žlázy

Odehrává se hlavně až po narození

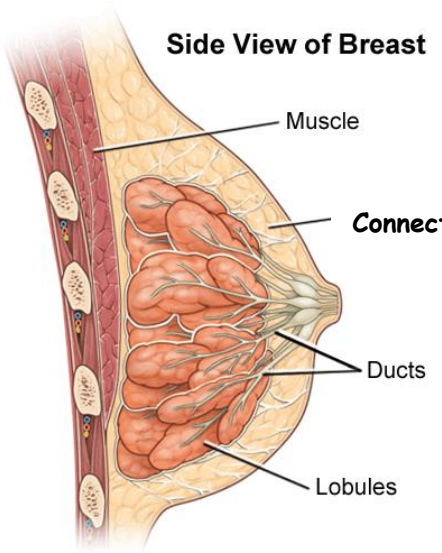


At **puberty** changes in the hormonal secretions in females cause further development and structural changes within the glands.

Secretions of estrogen and progesterone from the ovaries (and later from the placenta) and prolactin from the acidophils of the anterior pituitary gland initiate development of lobules and terminal ductules.

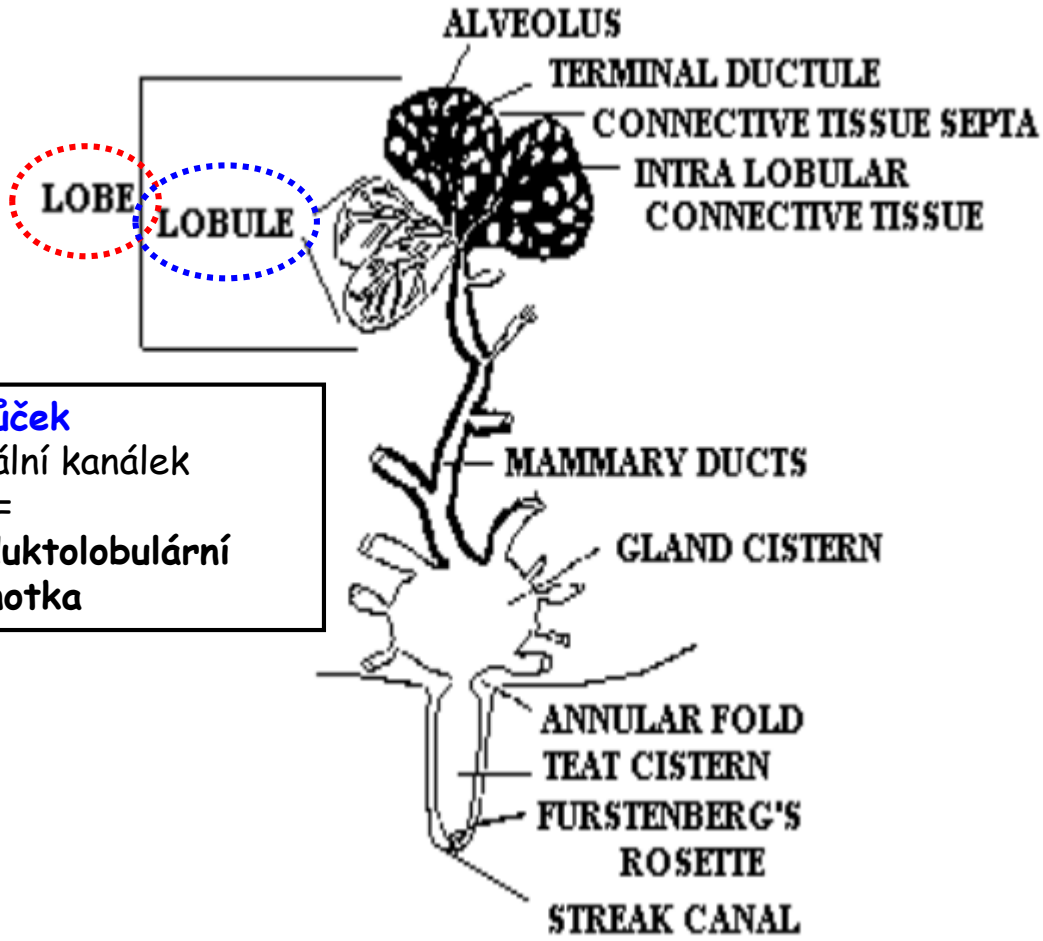
Full development of the ductal portion of the breast requires glucocorticoids and further activation by somatotropin.

Mléčná žláza – Anatomická organizace



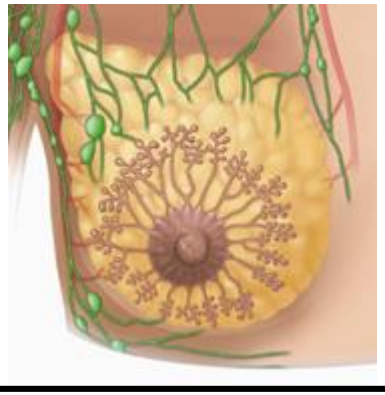
Lalok = 1 žláza

- total of 15 to 20 lobes
- 1 lalok – 1 hlavní vývod (ductus lactiferi - mlékovody)



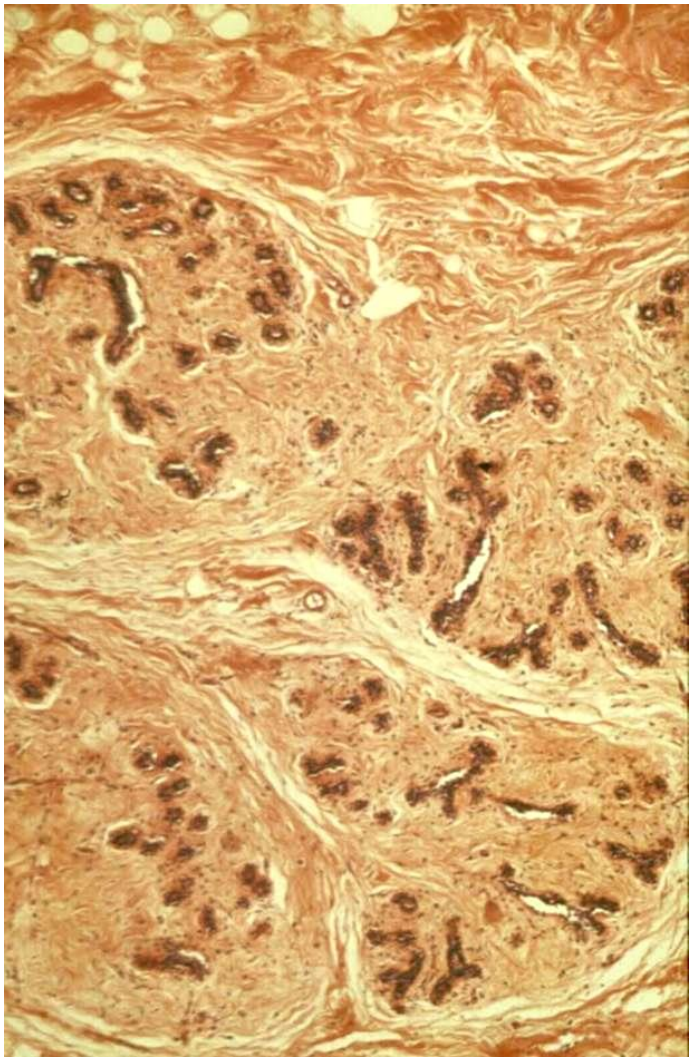
Lalůček
+ 1 terminální kanálek
=
Terminální duktolobulární jednotka

Radial organization

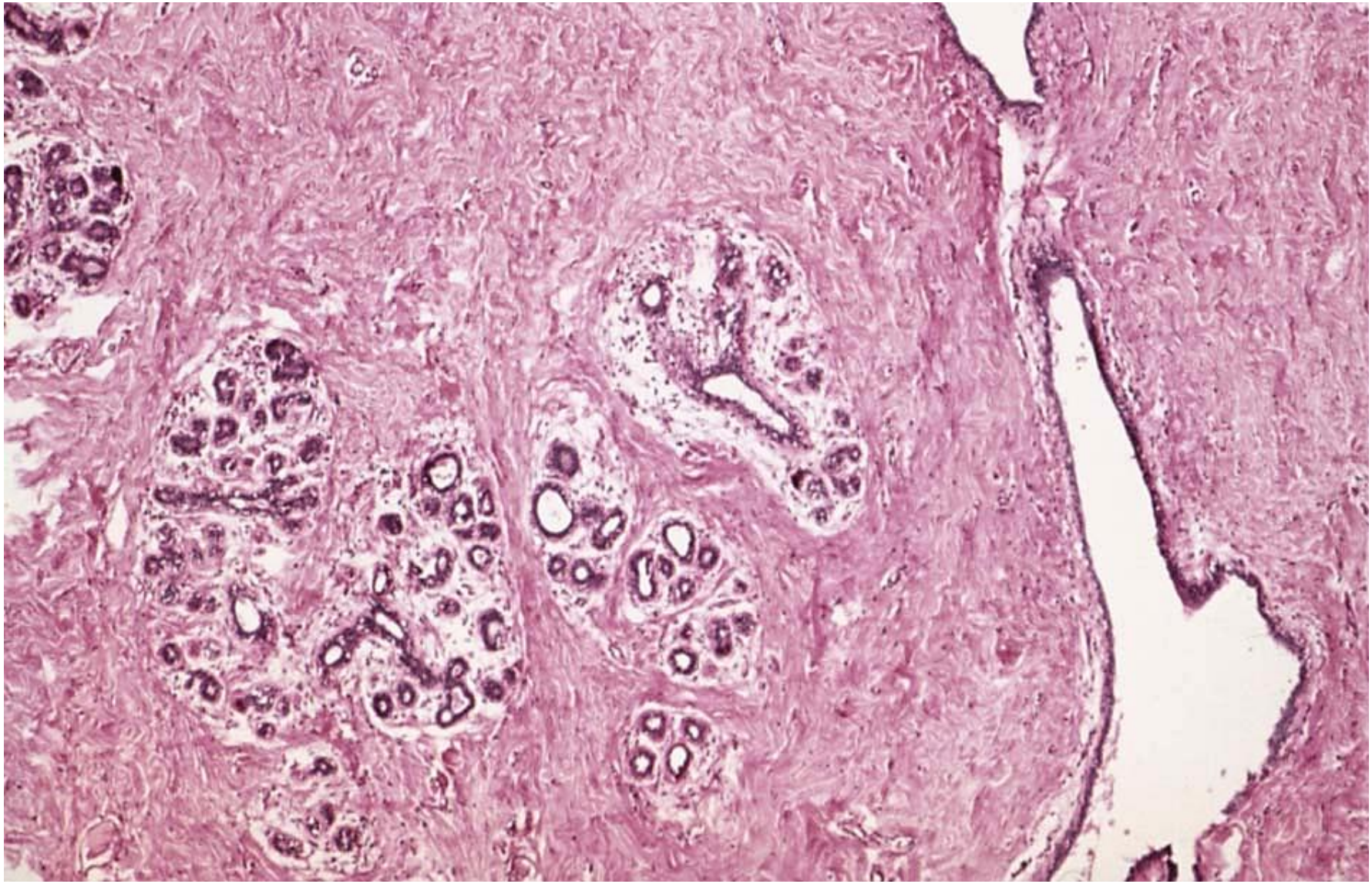


Mléčná žláza – Po pubertě – Nelaktující 1

- majority = connective tissue
- the same basic architecture as the lactating (active) mammary gland
- **Sekreční oddíly** - alveoli are not developed, only small groups of cells at the endings of ductuli
- **Vývody** – branched + partly luminized

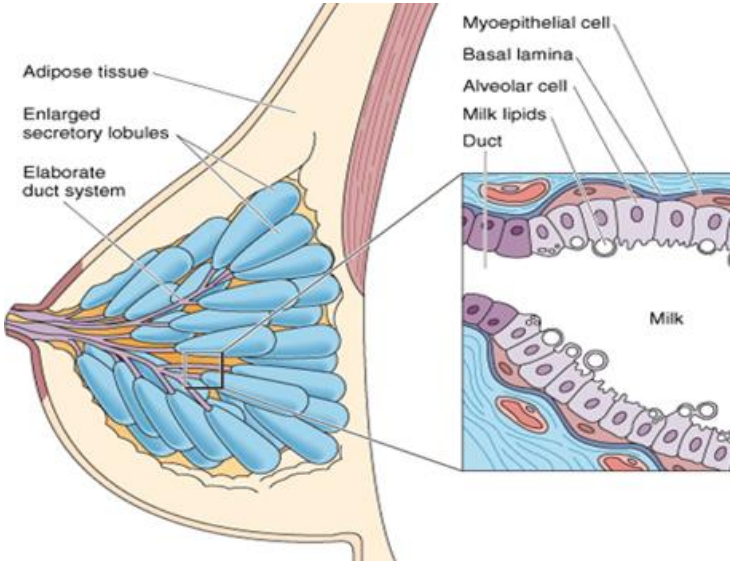


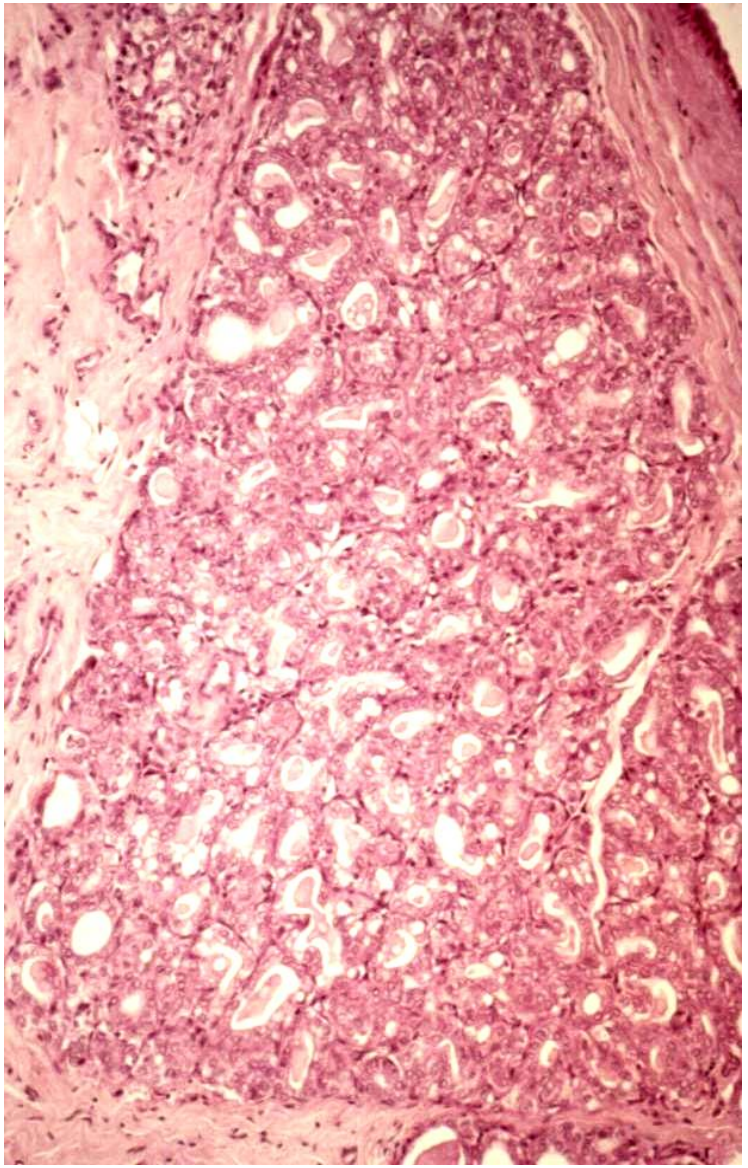
Mléčná žláza – Po pubertě – Nelaktující 2



Mléčná žláza – Laktující 1

- majority = glands
- **Vývodní oddíly:** proliferate, branch, luminize (estrogens)
- **Sekreční alveoly:** proliferation, luminization (progesterone, prolactin)
- connective tissue – only thin septa





Mléčná žláza – Laktující 2

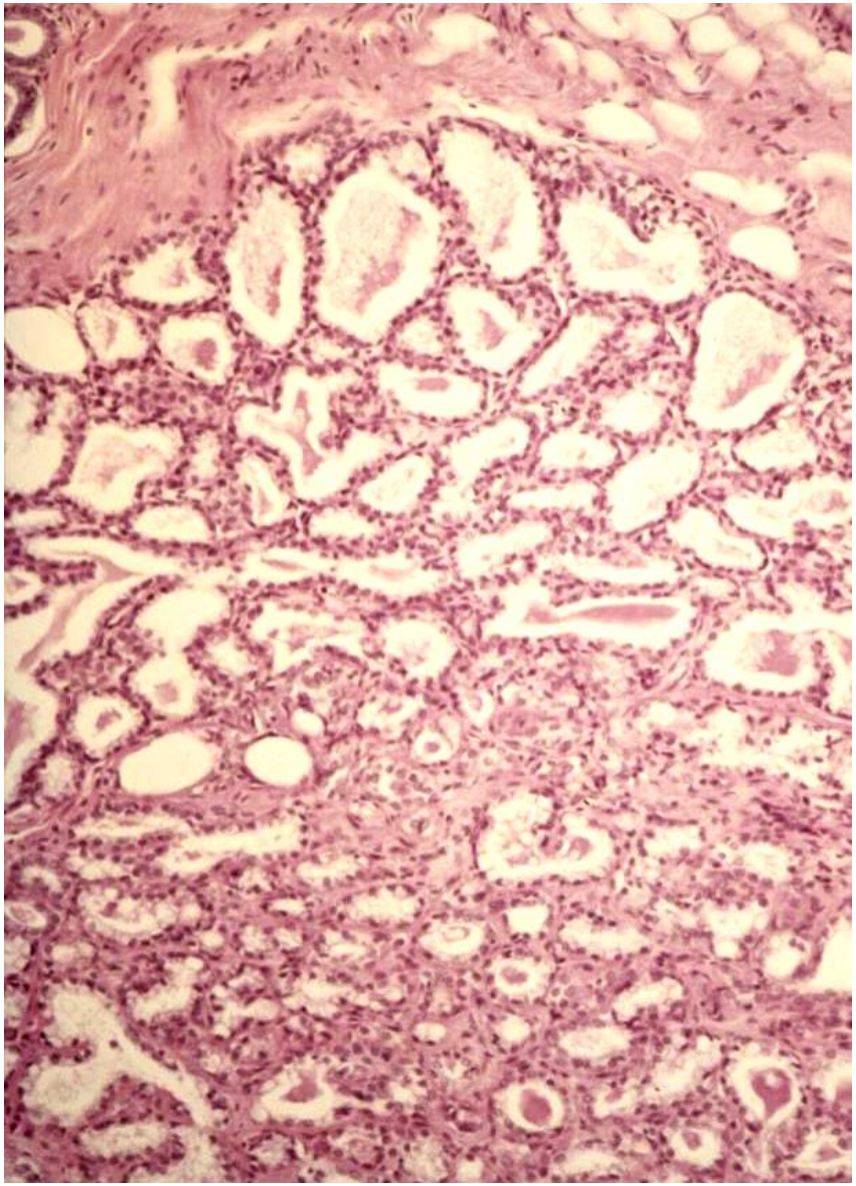
- **Sekreční odddíly:** filled by secretion (lipid droplets = apocrine, proteins = eccrine - exocytosis)

- **Vývodní oddíly**:

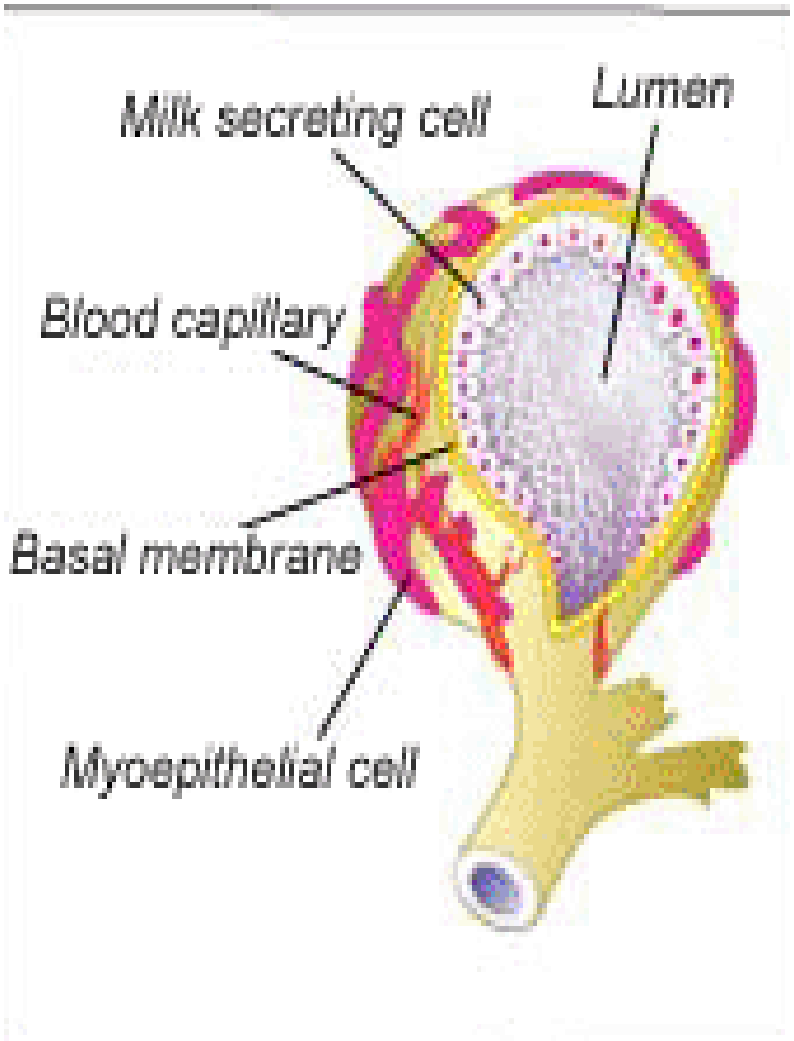
Kanálky v bradavce: vrstevnatý dlaždicový keratinizující ep.

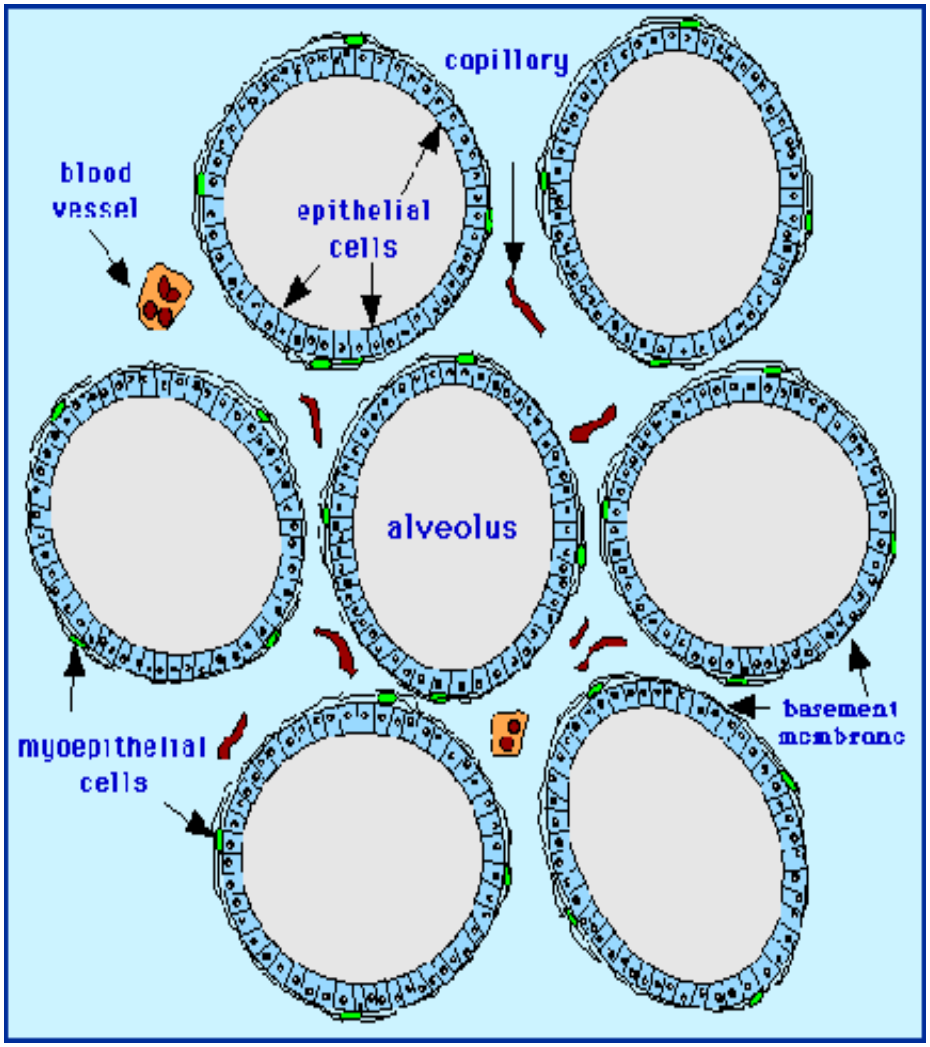
Sinus lactifer a ductus lactiferi: jednovrstvý/vrstevnatý kubický/cylindrický epitel

Terminální kanálky: jednovrstvý kubický ep. + myoepitelové buňky

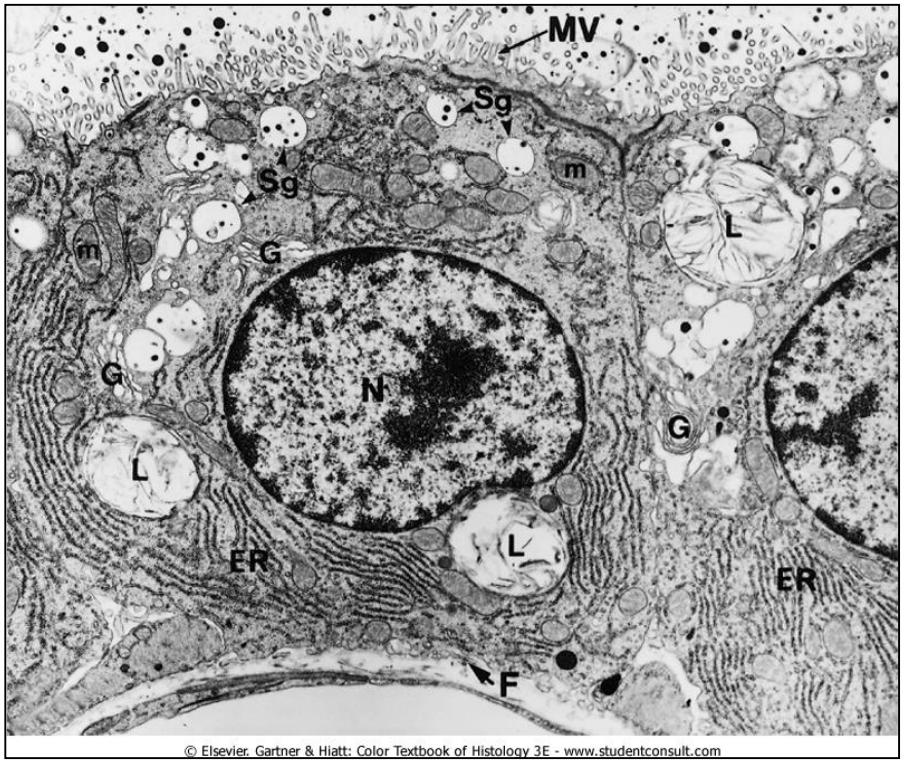


Mléčná žláza – Laktující 3





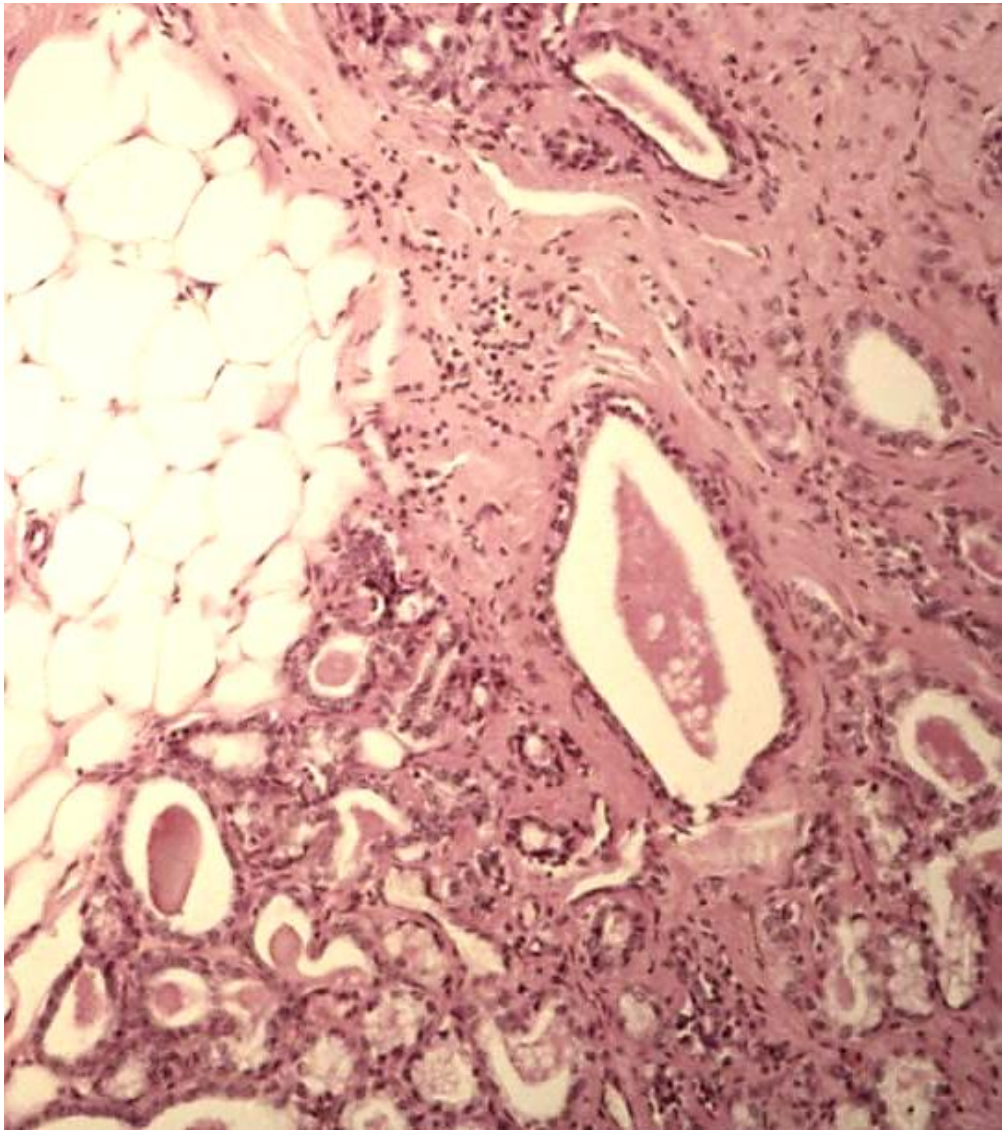
Mléčná žláza – Laktující 4

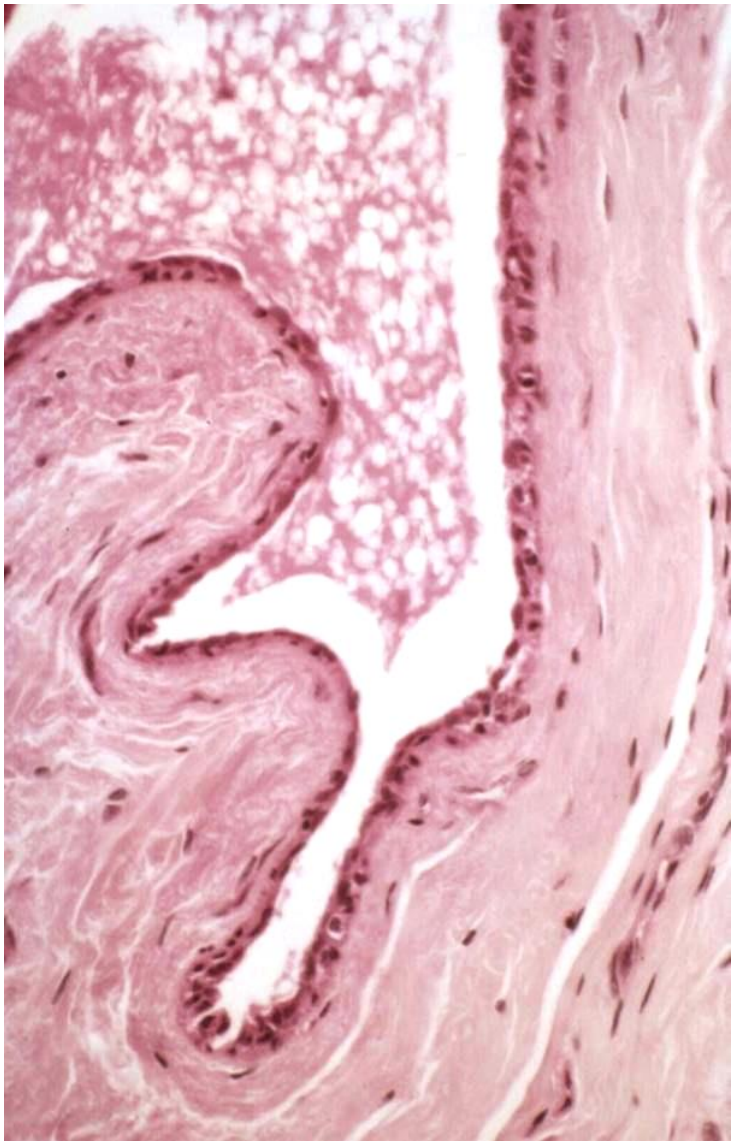


Electron micrograph of an acinar cell

- The **alveoli** are composed of cuboidal cells partially surrounded by a meshwork of myoepithelial cells.
- These secretory cells possess abundant RER and mitochondria, several Golgi complexes, many lipid droplets (apocrine secretion), and numerous vesicles containing caseins (milk proteins) and lactose (exocytosis).
- Not all regions of the alveolus are in the same stage of production, because different acini display varying degrees of preparation for synthesis of milk substances.

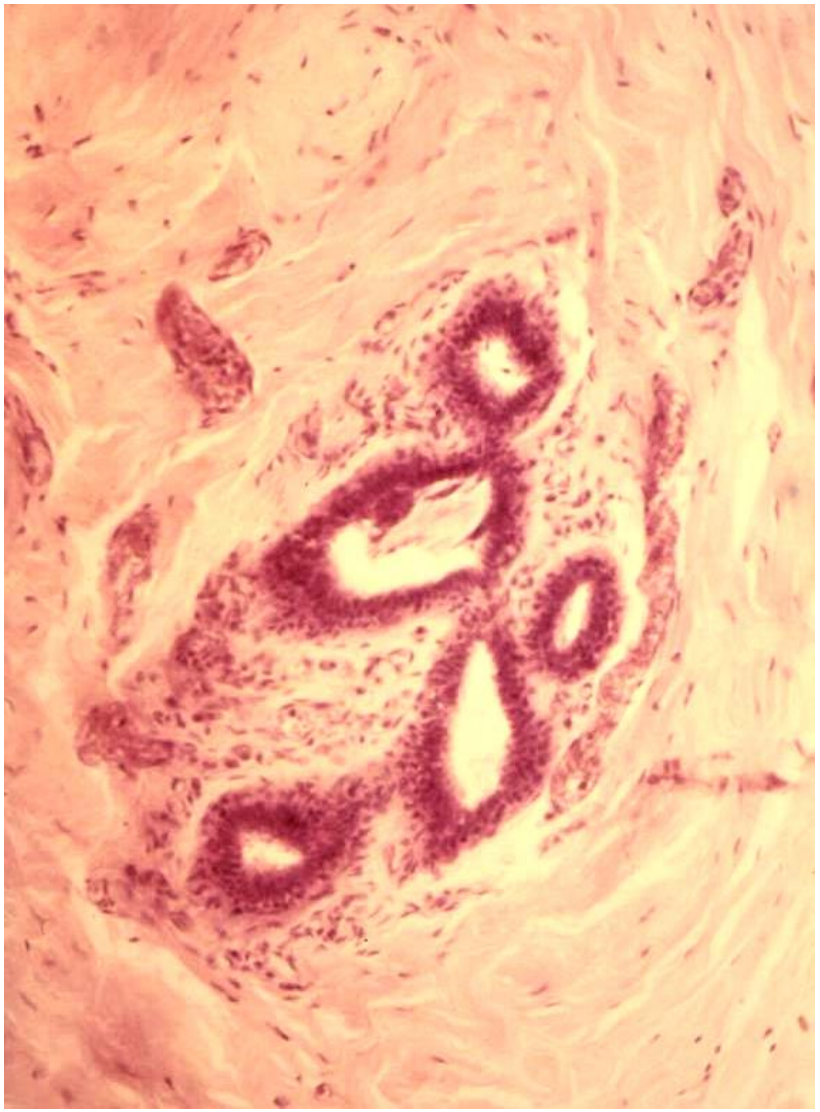
Mléčná žláza – Laktující 6



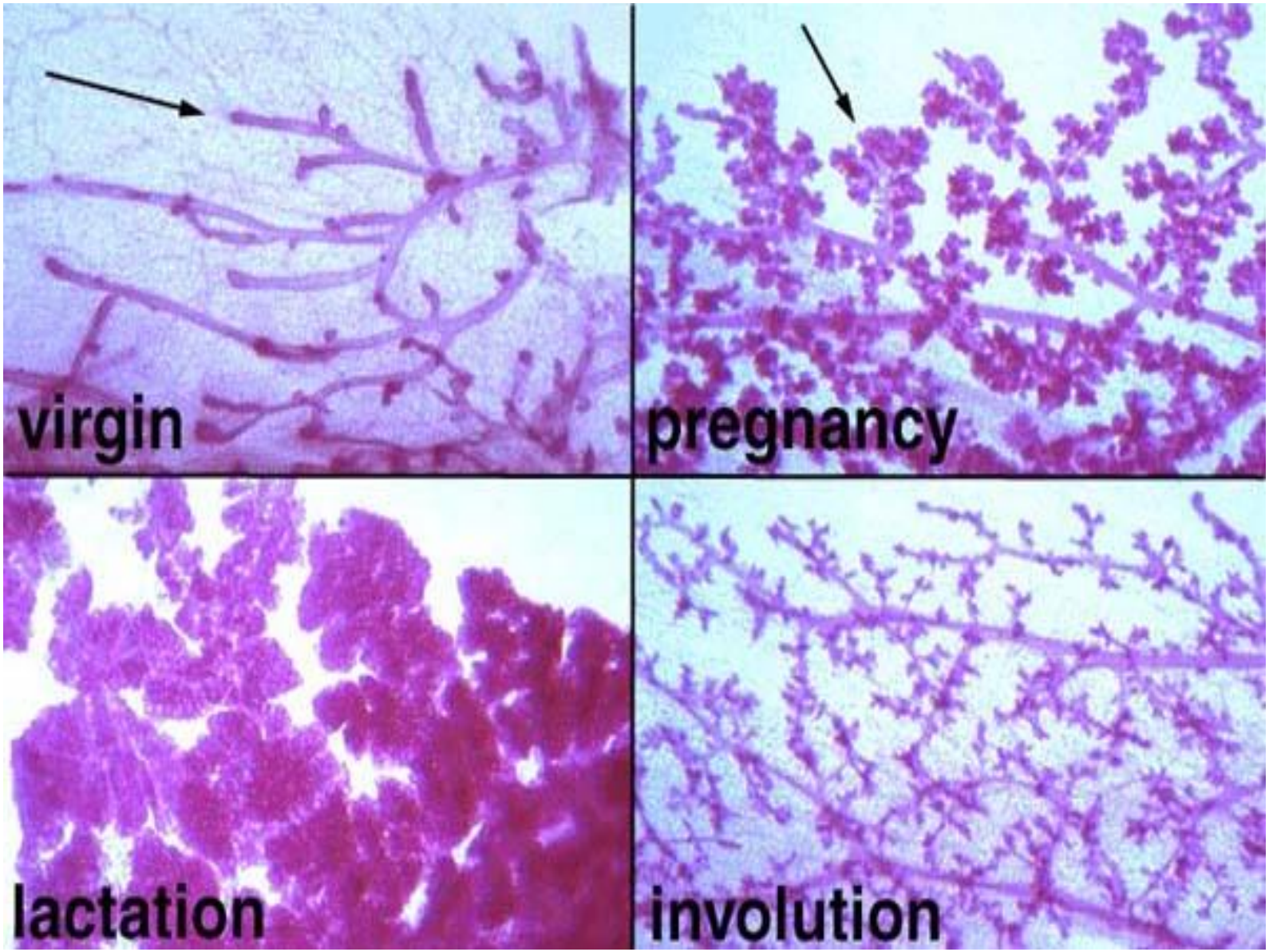


Mléčná žláza – Involuce

- atrophy and degeneration of the secretory cells
- milk biosynthesis ceases
- adipose cells occupy the empty space
- the duct system remains
- this process continues throughout menopause



Mléčná žláza – Stadia vývoje (funkce)



Vlas – Všeobecná stavba

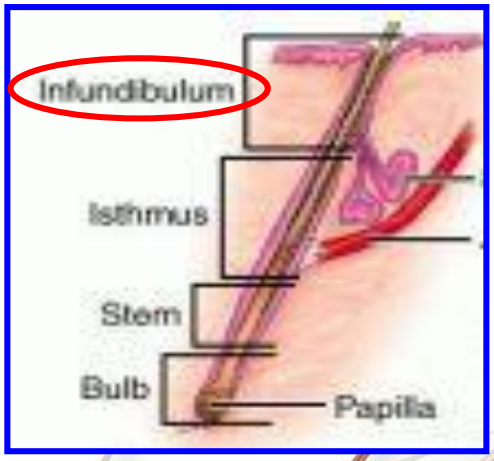
Stvol: portion of hair above surface
Kořen: portion of hair below surface
Kutikula: outermost layer of hair

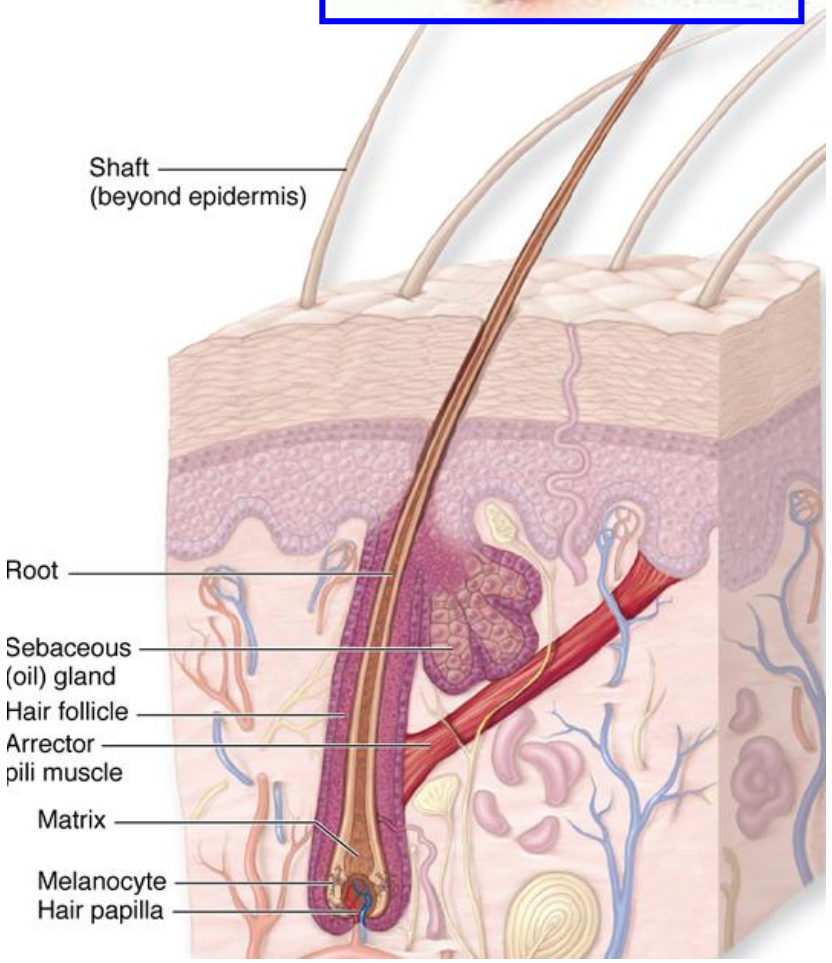
Vlasový folikul: invagination of epidermis (to dermis / hypodermis)

Vlasová cibulka: at the base of the follicle (matrix - epithelial cells + melanocytes)

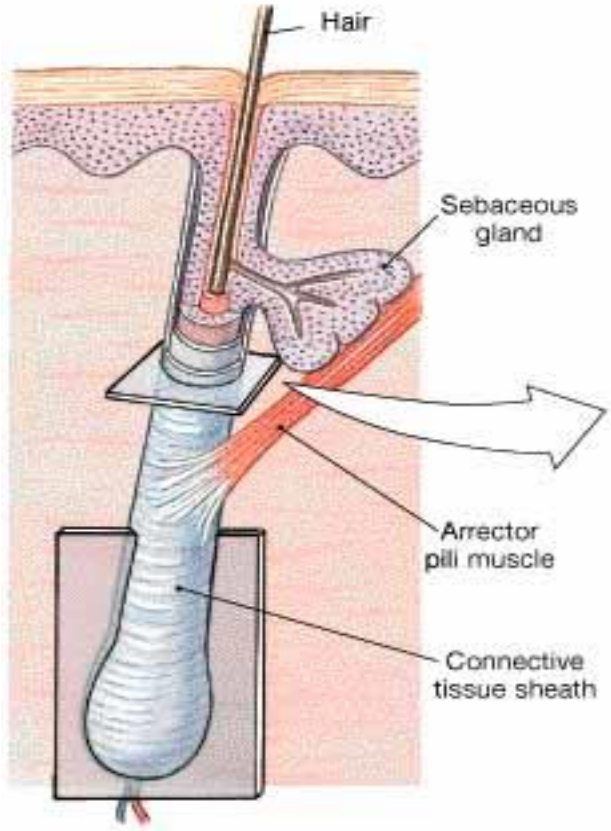
Vlasová papila: projection of dermal connective tissue into bulb - contains blood vessels and nerves

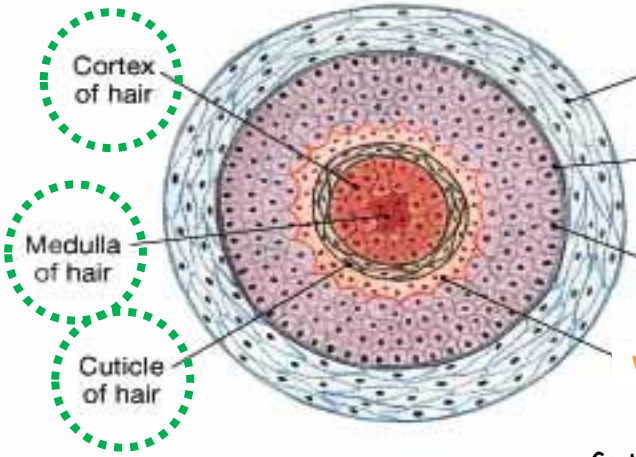
Velusové x Terminální chlupy



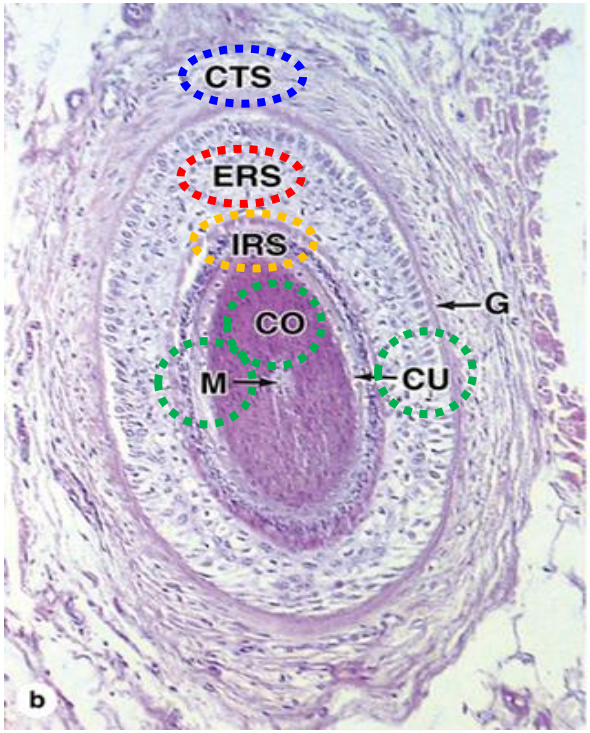


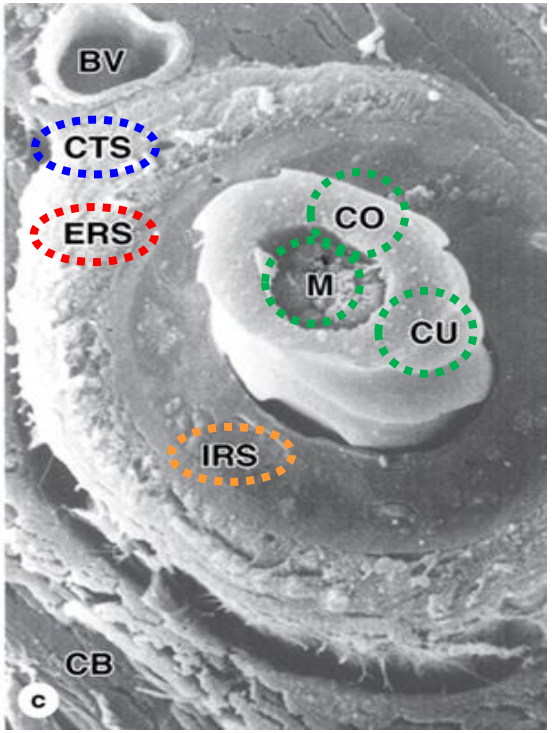
Struktura vlasu 1



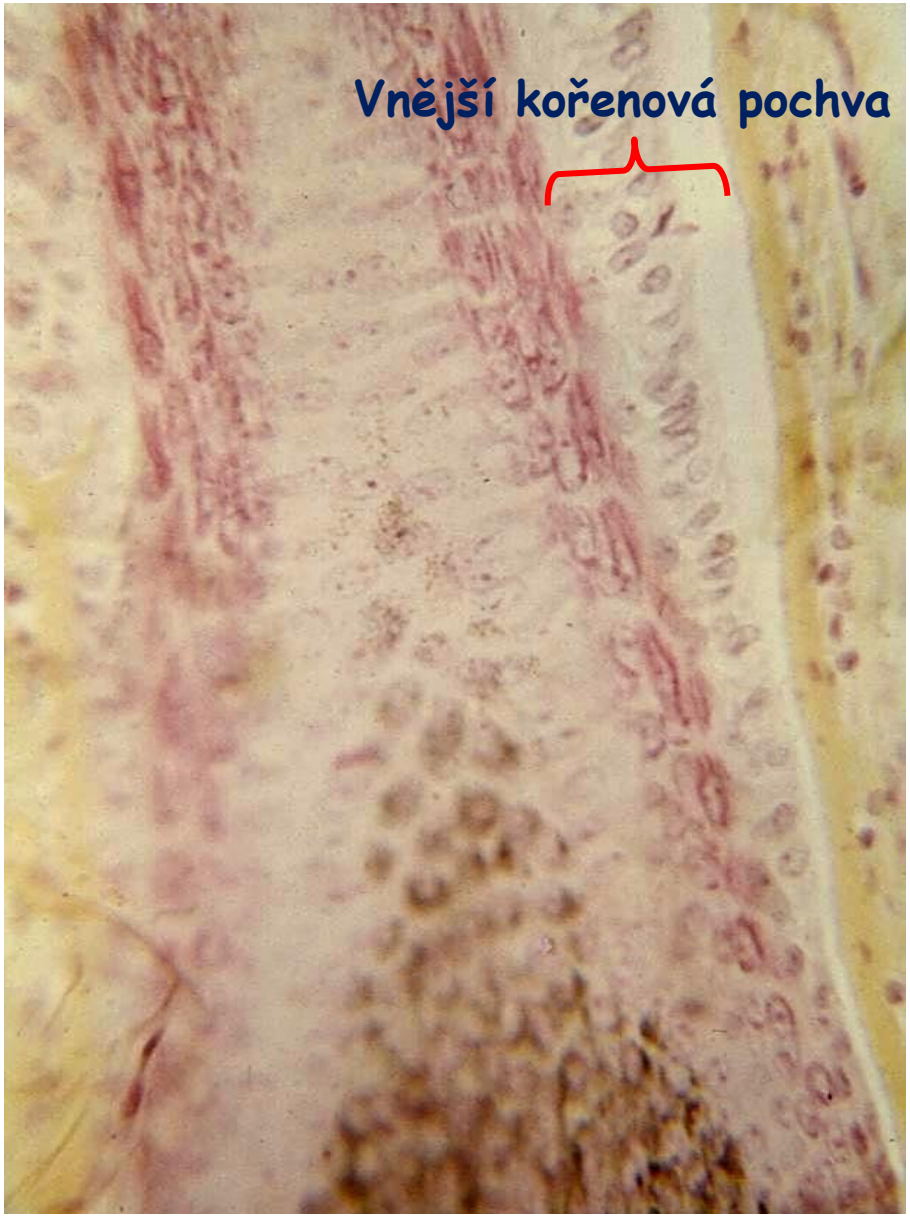


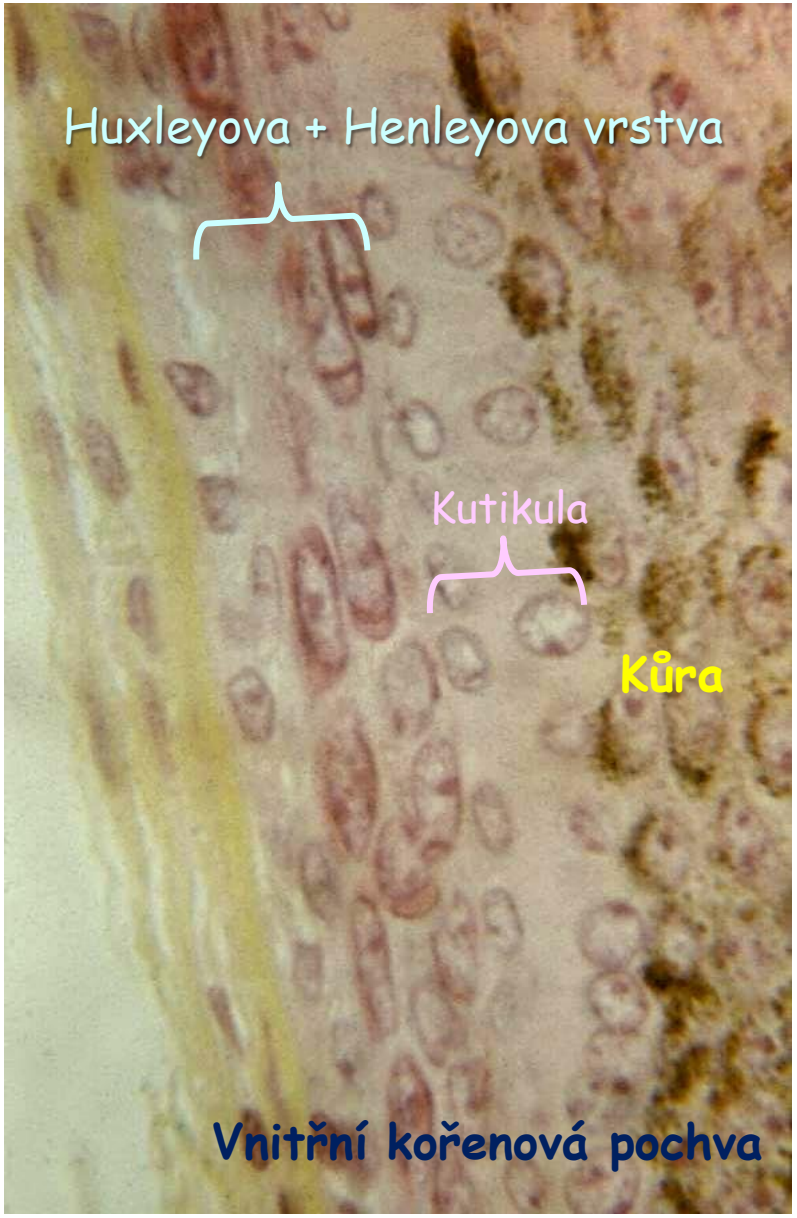
Garther and Hiatt, Color textbook of histology, Elsevier



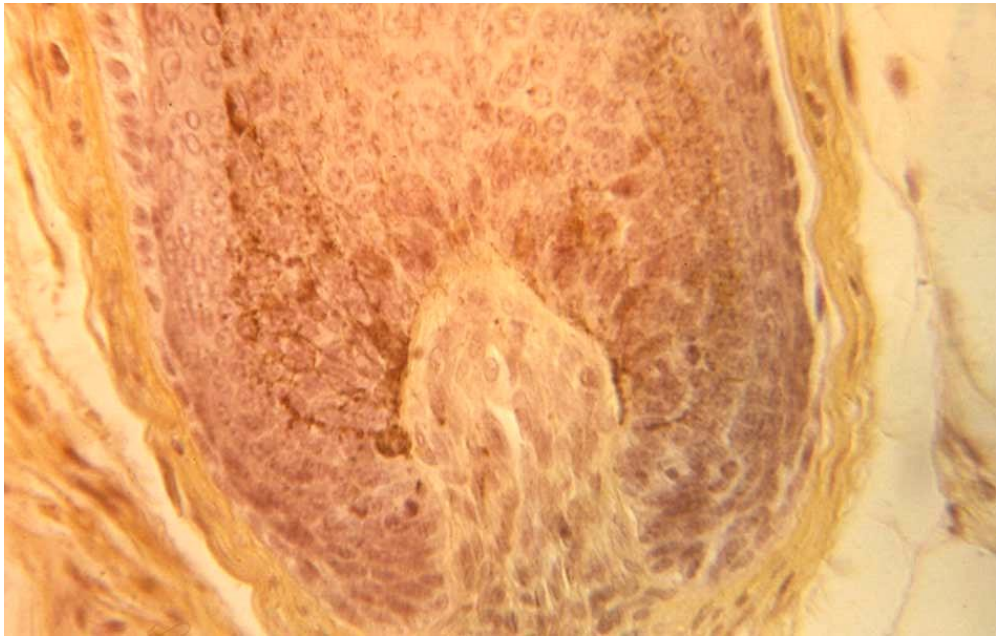


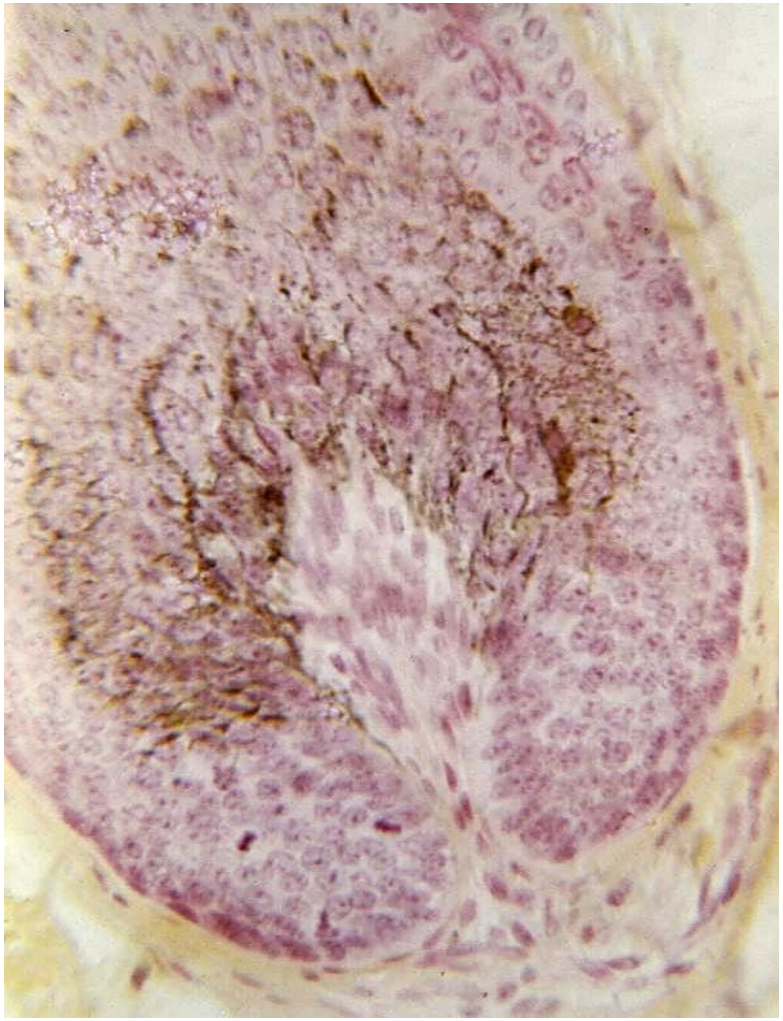
Struktura vlasu 2



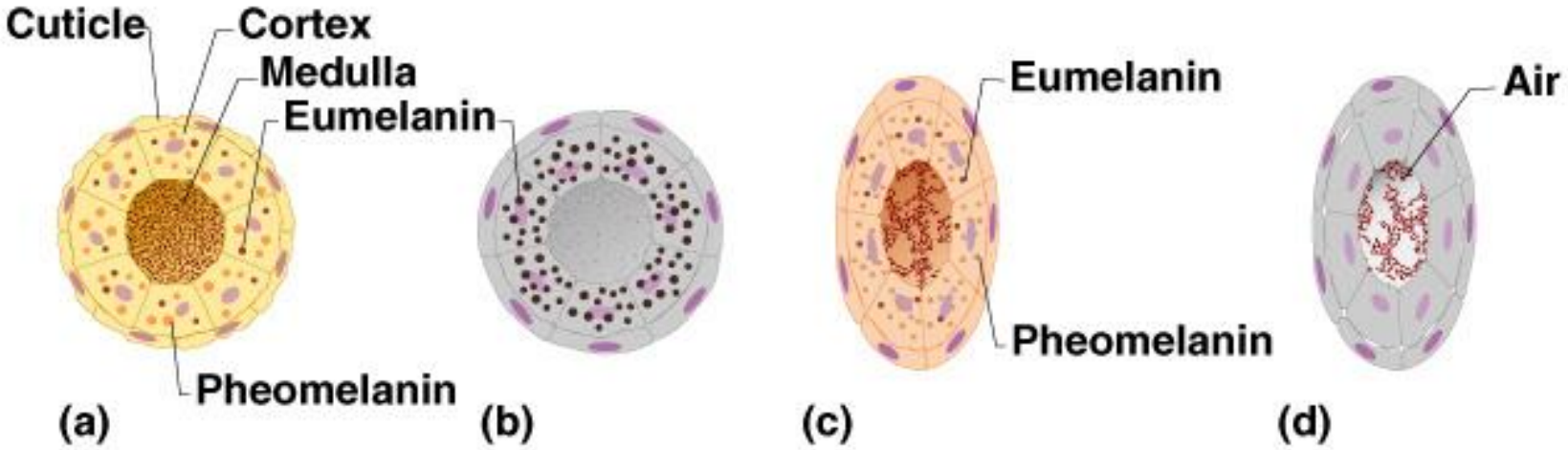


Vlasová cibulka a papila

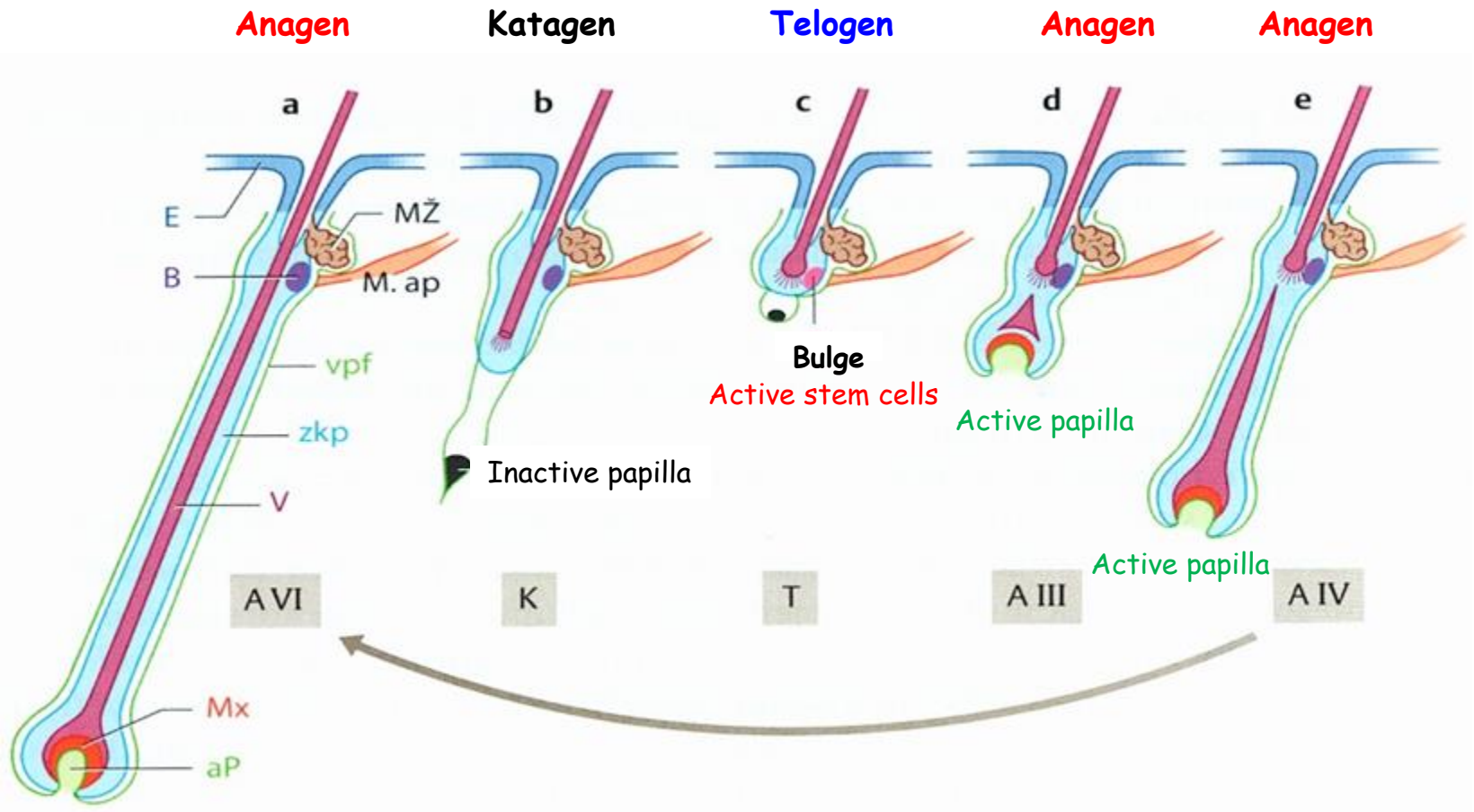




Vlasy – barva a tvar



Vlasový cyklus

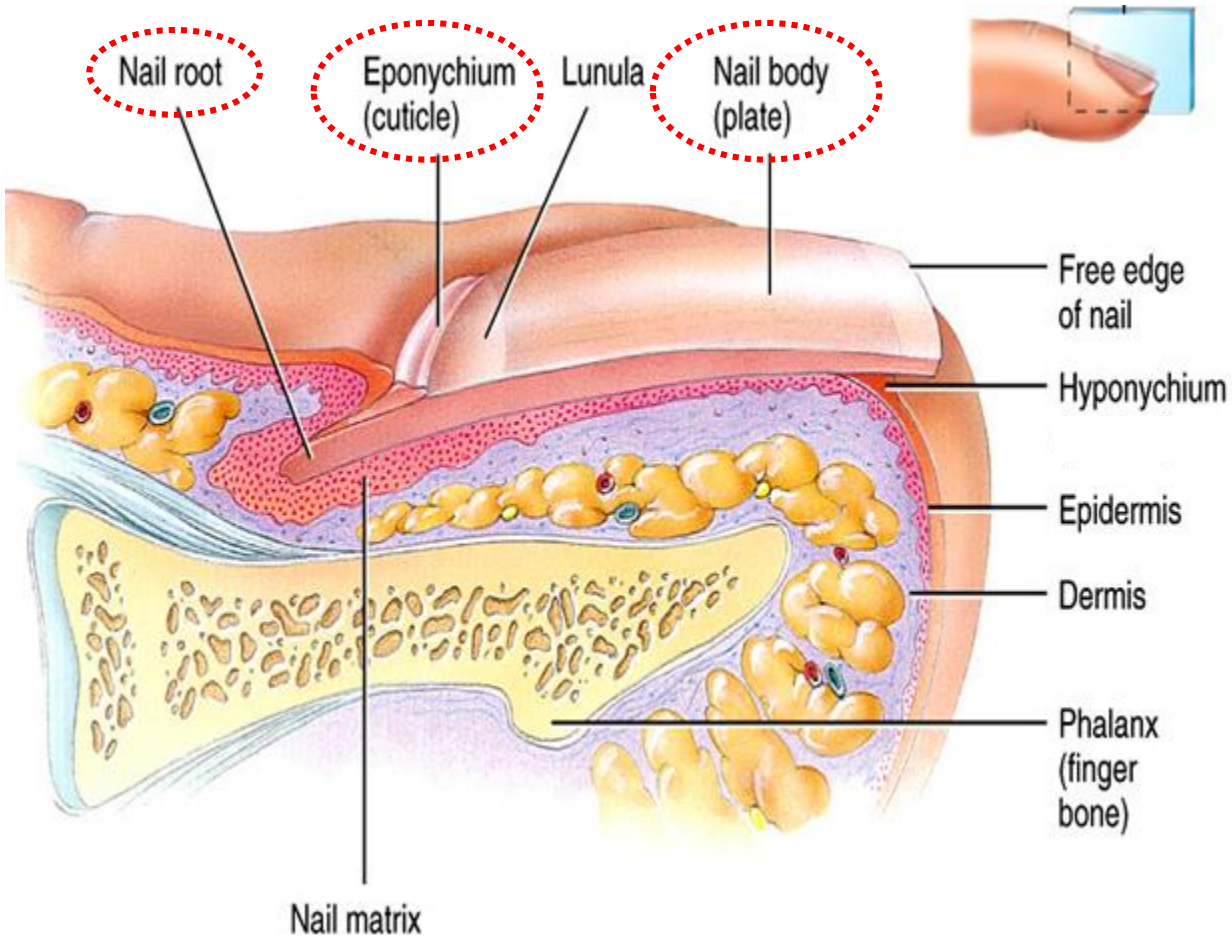


Active papilla

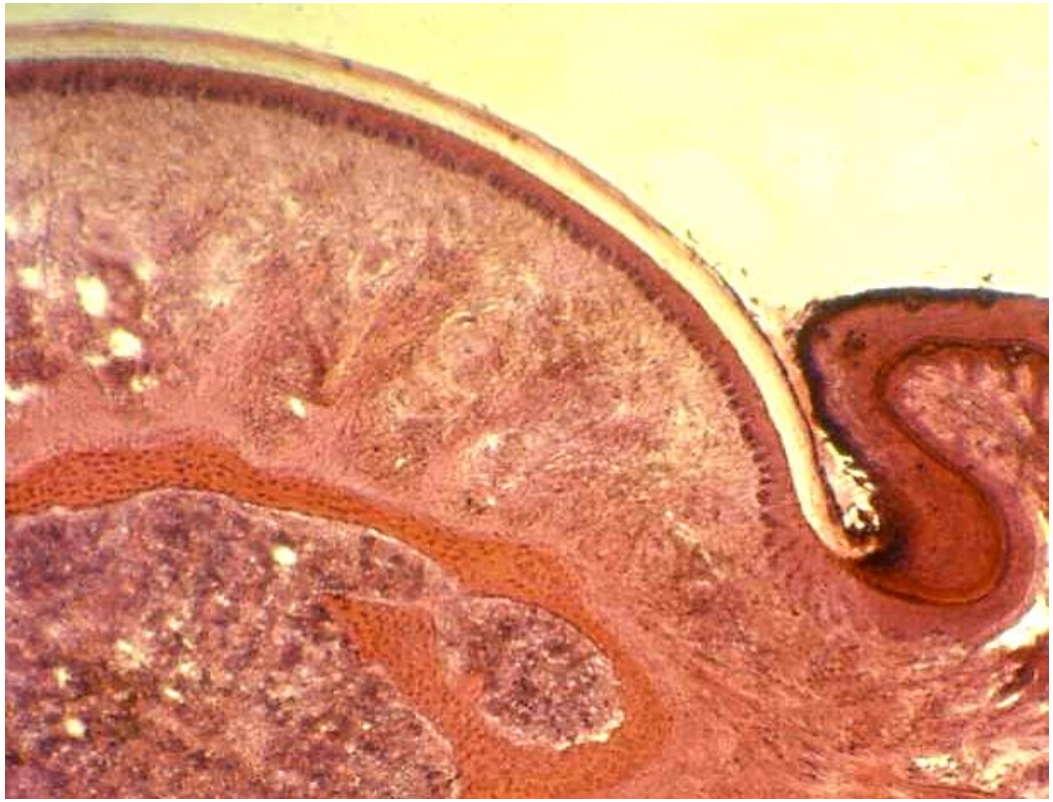
Anagen – months to years
Katagen – 3 weeks (involution)
Telogen – 3 months (resting)

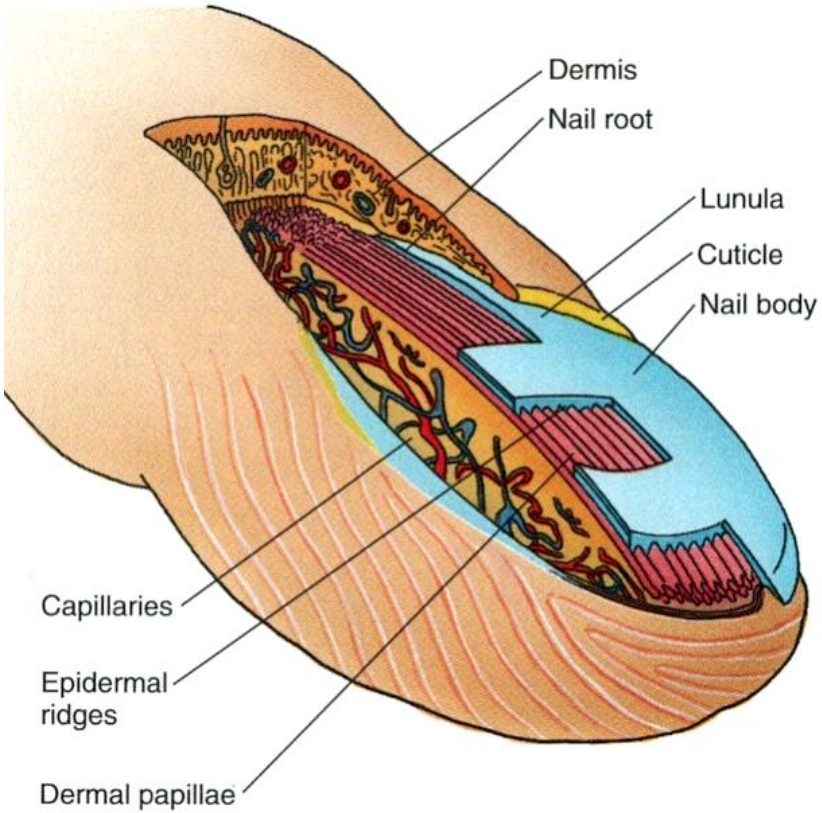
Nehet 1

Nehtová ploténka (tělo) – str. corneum
Nehtové lůžko – str. basale + spinosum + dermis
Matrix – str. germinativum



Nehet 2

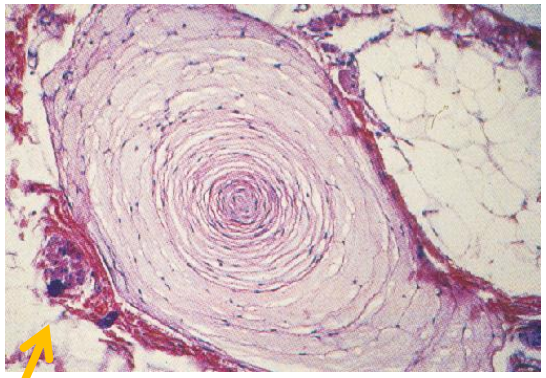



Dermis
Nail root
Lunula
Cuticle
Nail body
Capillaries
Epidermal ridges
Dermal papillae

Podkoží - Hypodermis

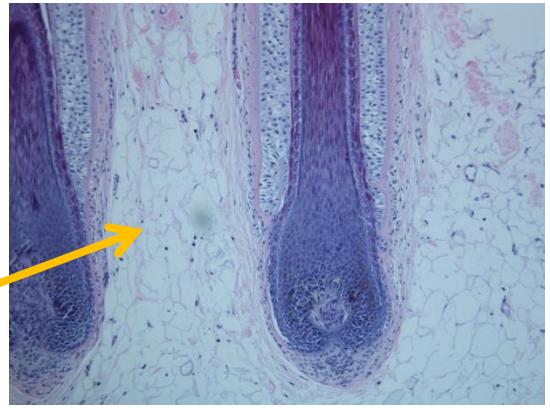
Area deep to the dermis

- Řídké vazivo obsahující adipocyty, nervy, sensorické receptors, arterie a vény (deep rete cutaneum)
- Provides a flexible attachment to the underlying muscle and fascia



Pacinian Corpuscle

Adipocytes



Hair bulb in the subcutis of the scalp

Vývoj kůže

Ektoderm

- Epidermis
- Adnexa

Mesenchym

(mesoderm - dermatomy + nesegmentovaný mesoderm - somatopleura)

- Dermis
- Hypodermis

A – Month 1 – simple surface ektoderm

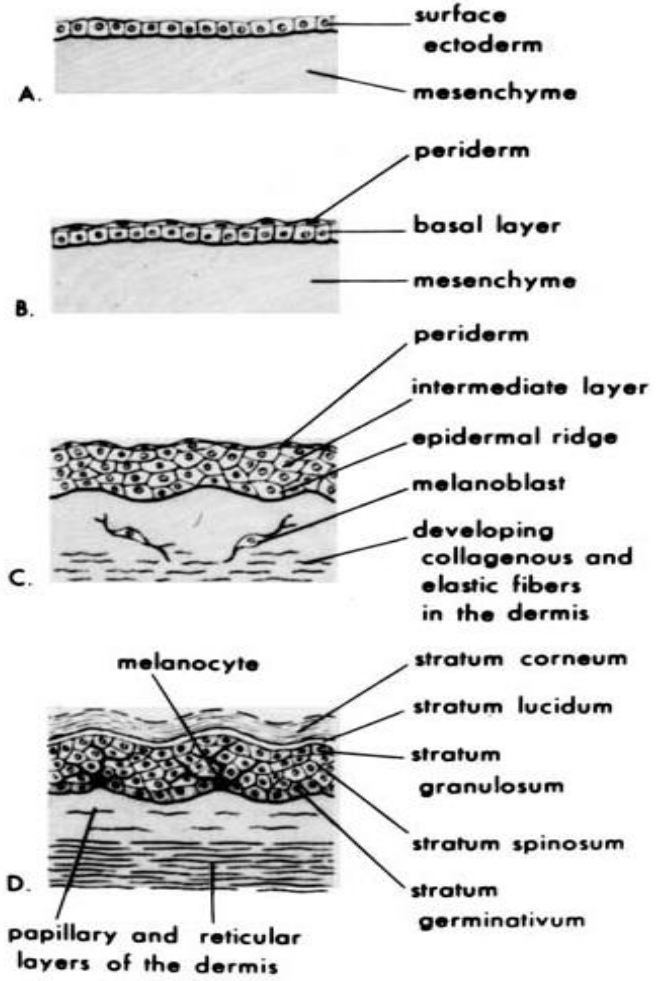
B – Month 2 – two layered epithelium:

basal layer + periderm (epitrichium)

C – Month 3 – basal + intermediary + periderm layers

(week 10-17 – formation of dermal ridges)

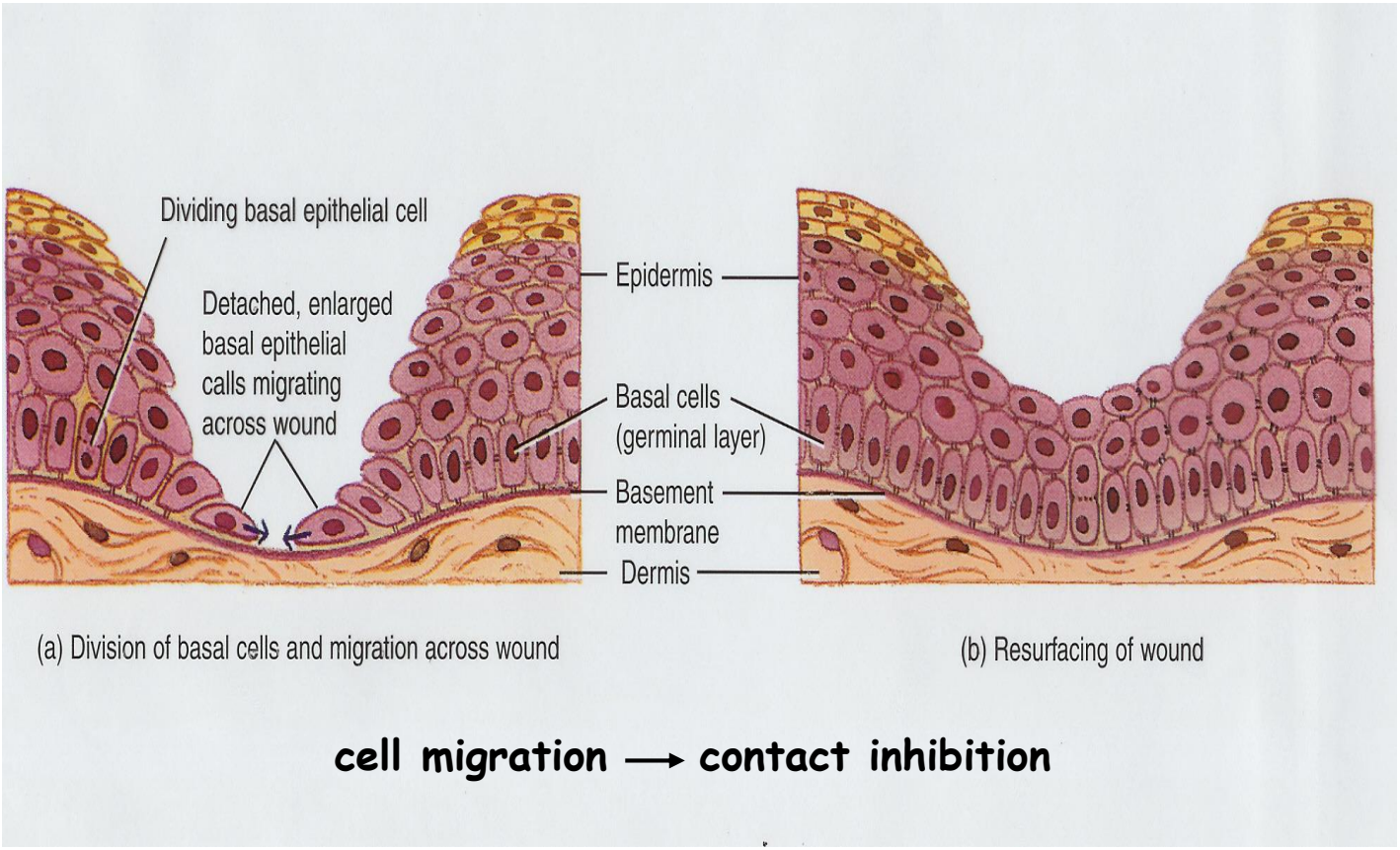
D – Month 5 (end) – periderm replaced by stratum corneum



Hojení kožních ran 1

Povrchové rány

Hluboké rány

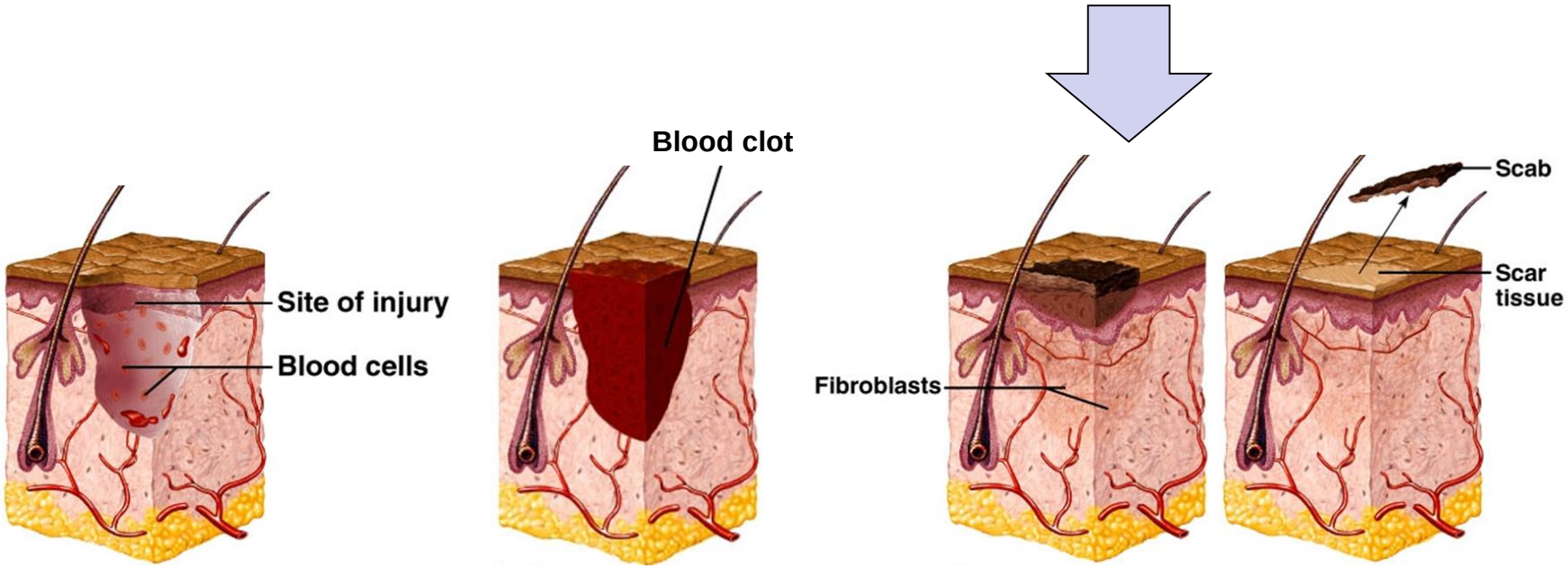


cell migration → contact inhibition

Hojení kožních ran 2

Povrchové rány

Hluboké rány



Inflammatory phase → **Migratory phase** → **Maturation phase**
+
Proliferative phase

Fibrin tvoří sraženinu

Fibroblasty tvoří granulační tkáň
hypertrophic scar = keloid

Děkuji za pozornost !

Otázky a komentáře na:
ahampl@med.muni.cz