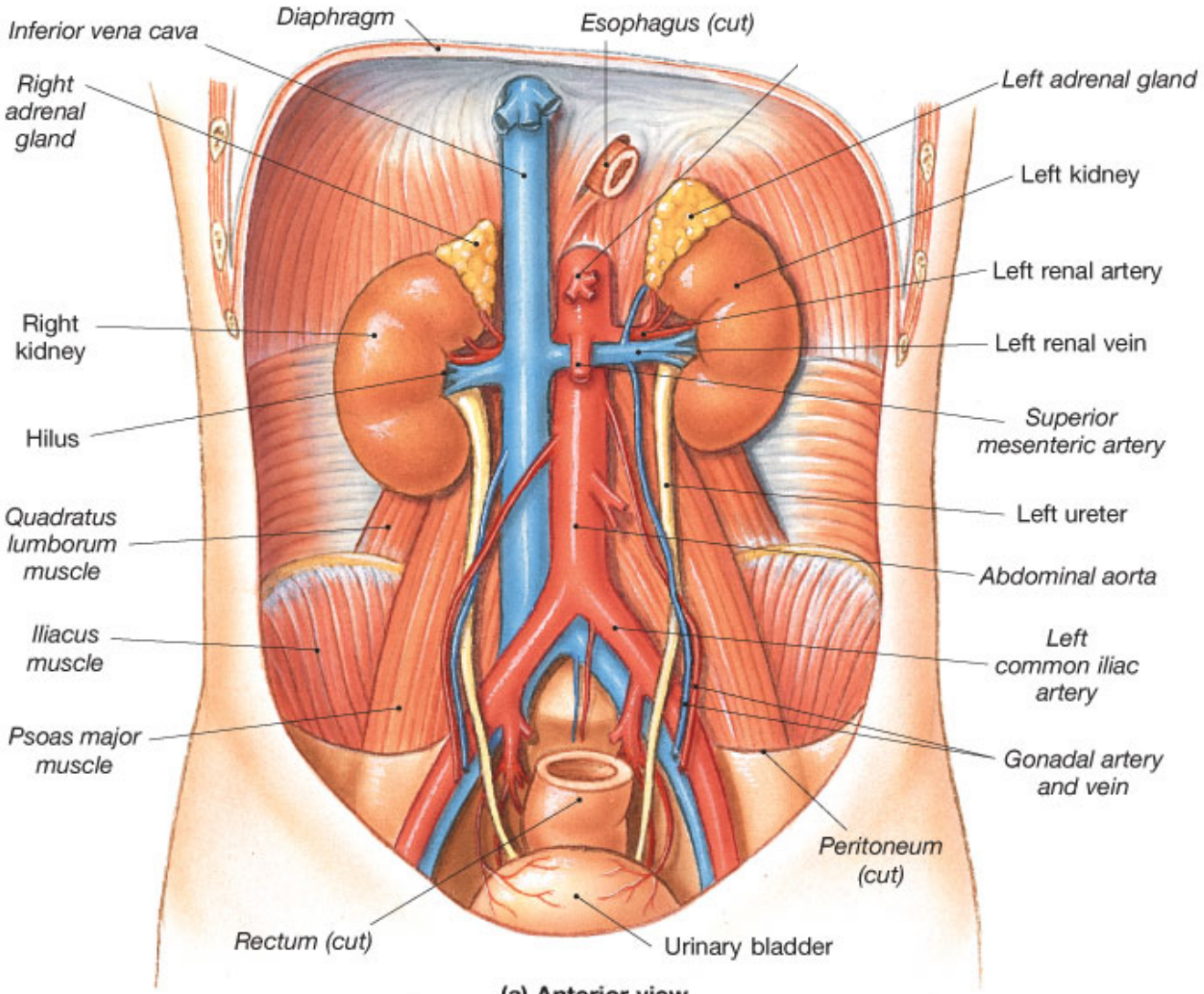
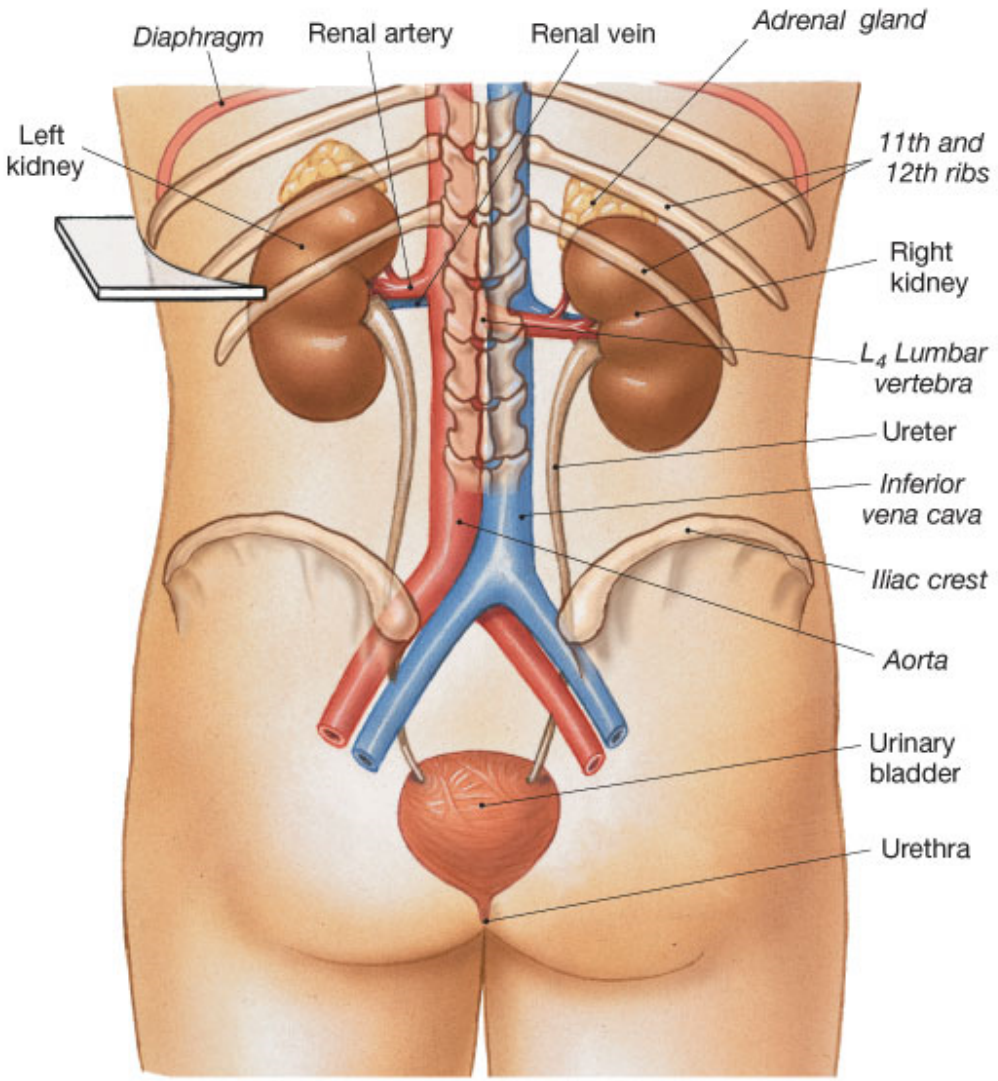
The Renal System

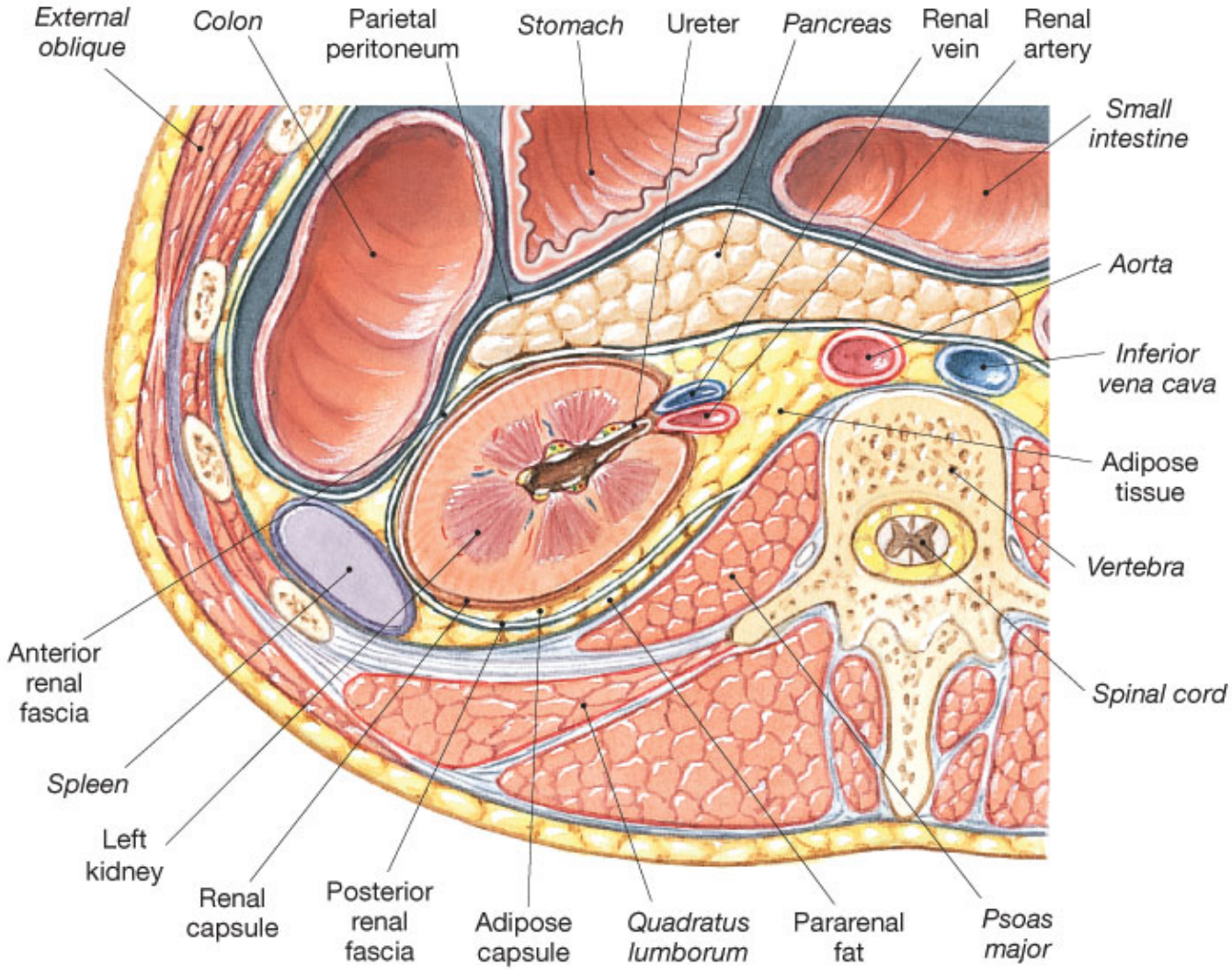


(a) Anterior view



(b) Posterior view

Transverse Section



There are 4 Processes in the kidneys:

1. **Filtration:** at Glomerulus – net movement of substances from glomerulus to Bowman's space.

2. **Resabsorption:** – net movement of substances from renal tubules and collecting duct into peritubular & vasa recta capillaries.

3. **Secretion:** – net movement of substances from peritubular & vasa recta capillaries into renal tubules.

4. **Excretion:** – elimination of urine from body.

Outer renal cortex

Inner renal medulla

Renal pyramid

Renal columns

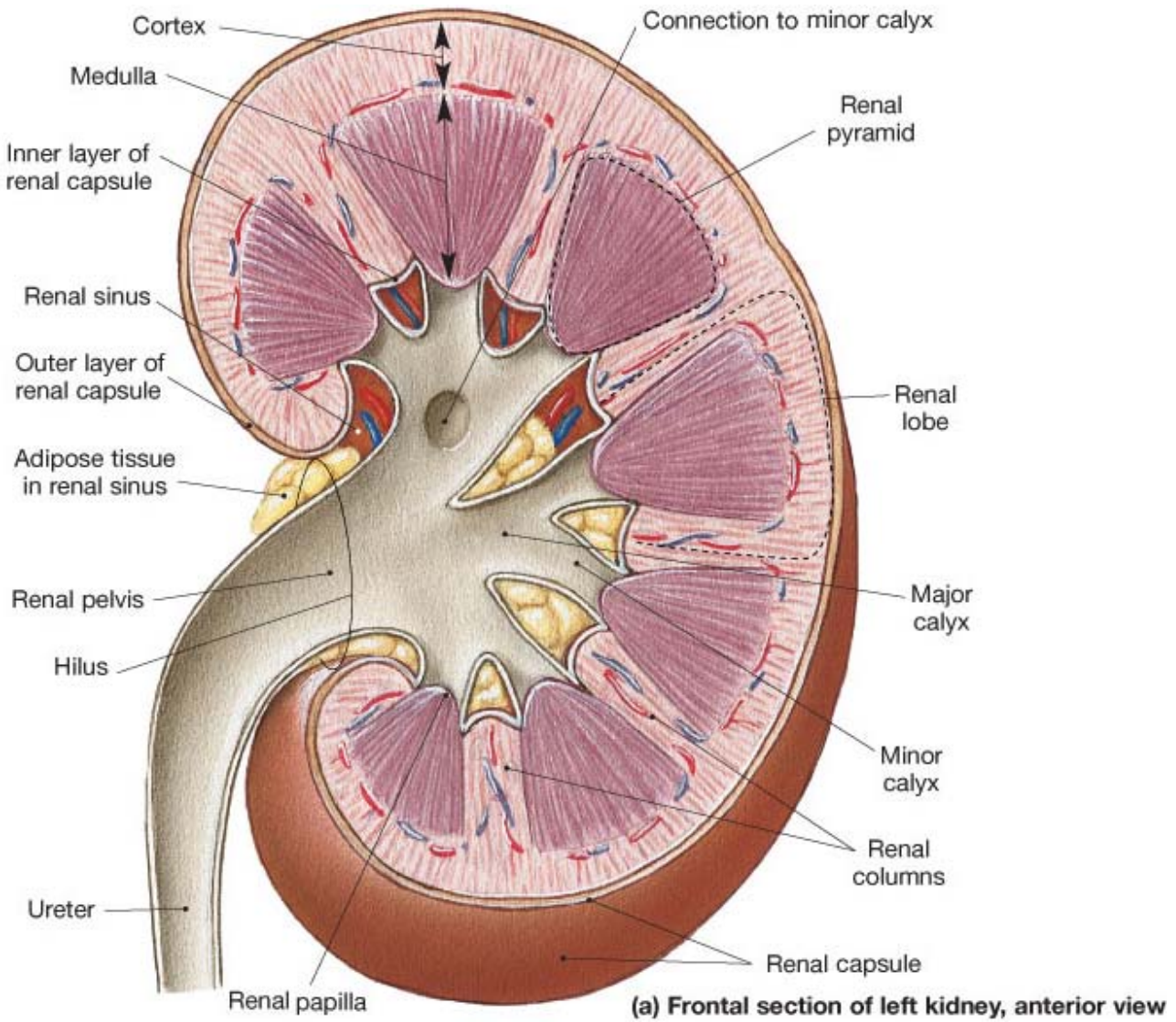
Renal papilla

Minor calyx

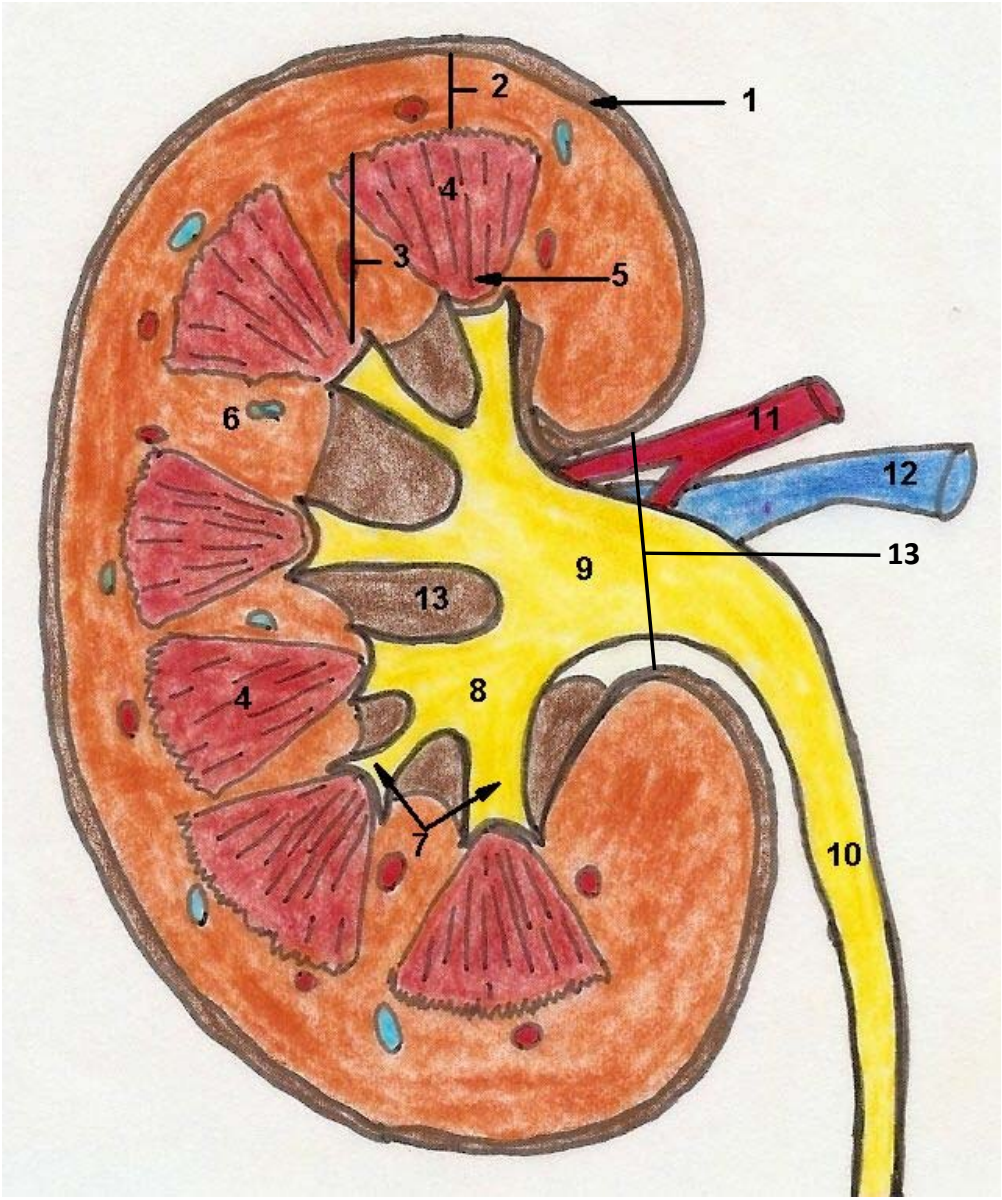
Major calyx

Renal pelvis

Ureter



(a) Frontal section of left kidney, anterior view


1
2
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5
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8
7
10

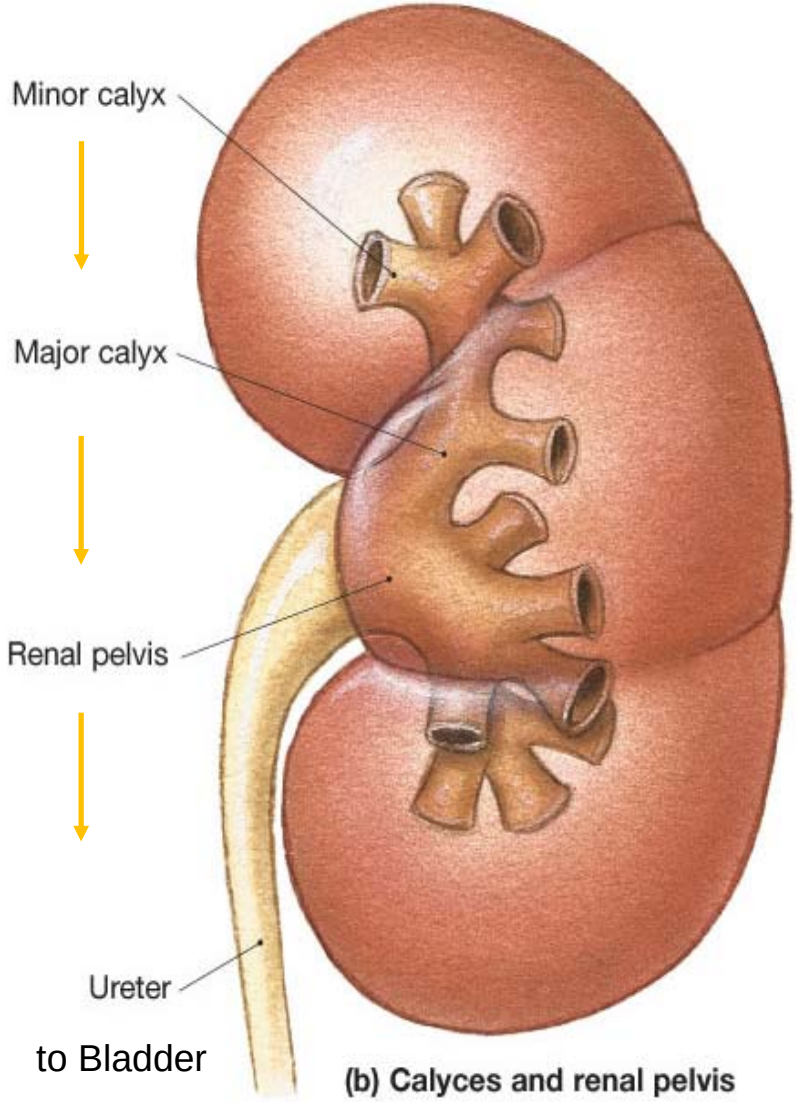
Collection of Urine in the Renal Systems

Calyx – ‘cup’

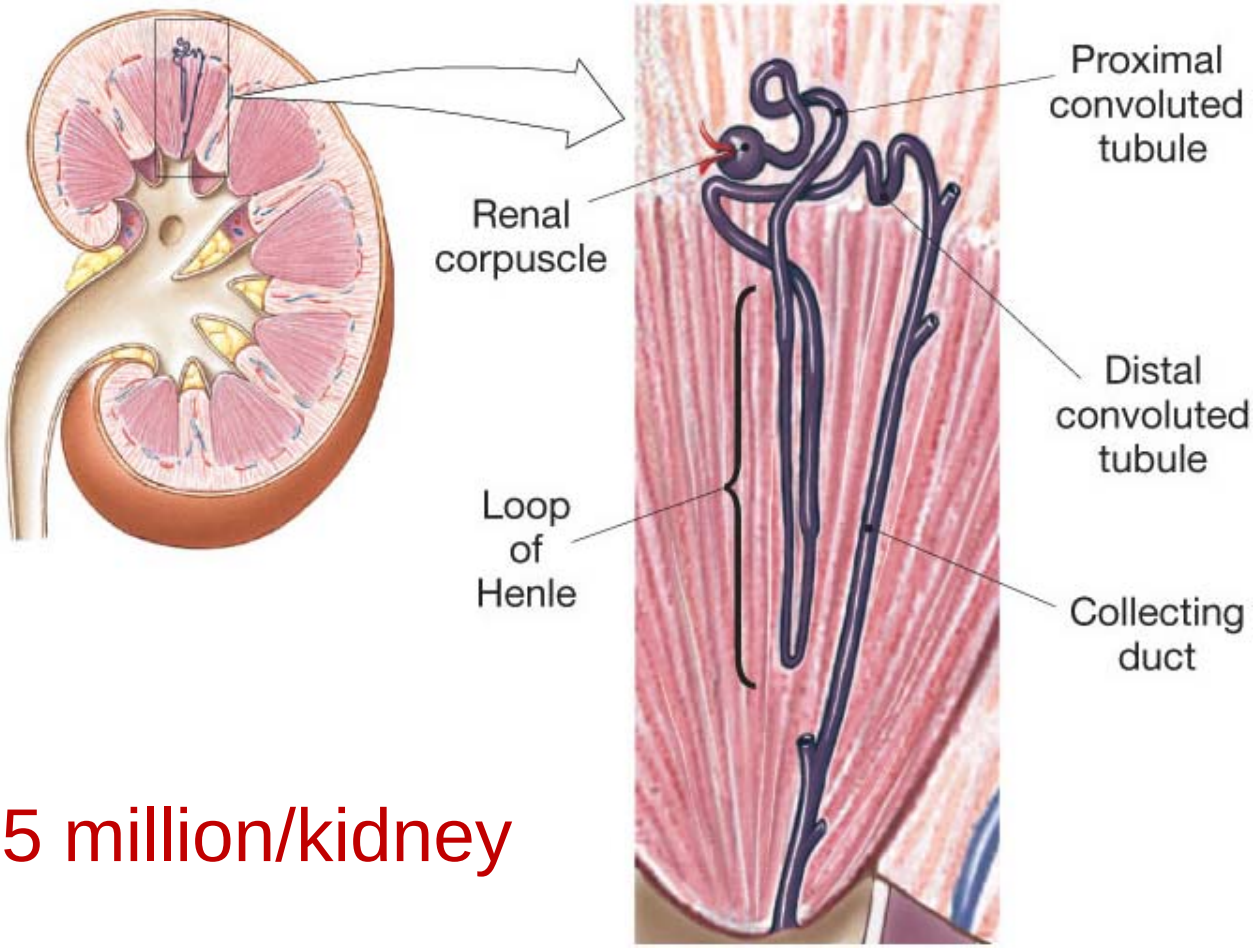
Pelvis = basin

Calyx - singular

Calicies - plural



The Nephron – Functional Unit



1.25 million/kidney

The Nephron has 2 parts:

1. Renal Corpuscle

a) Glomerulus

b) Bowman’s Space

c) Bowman’s Capsule

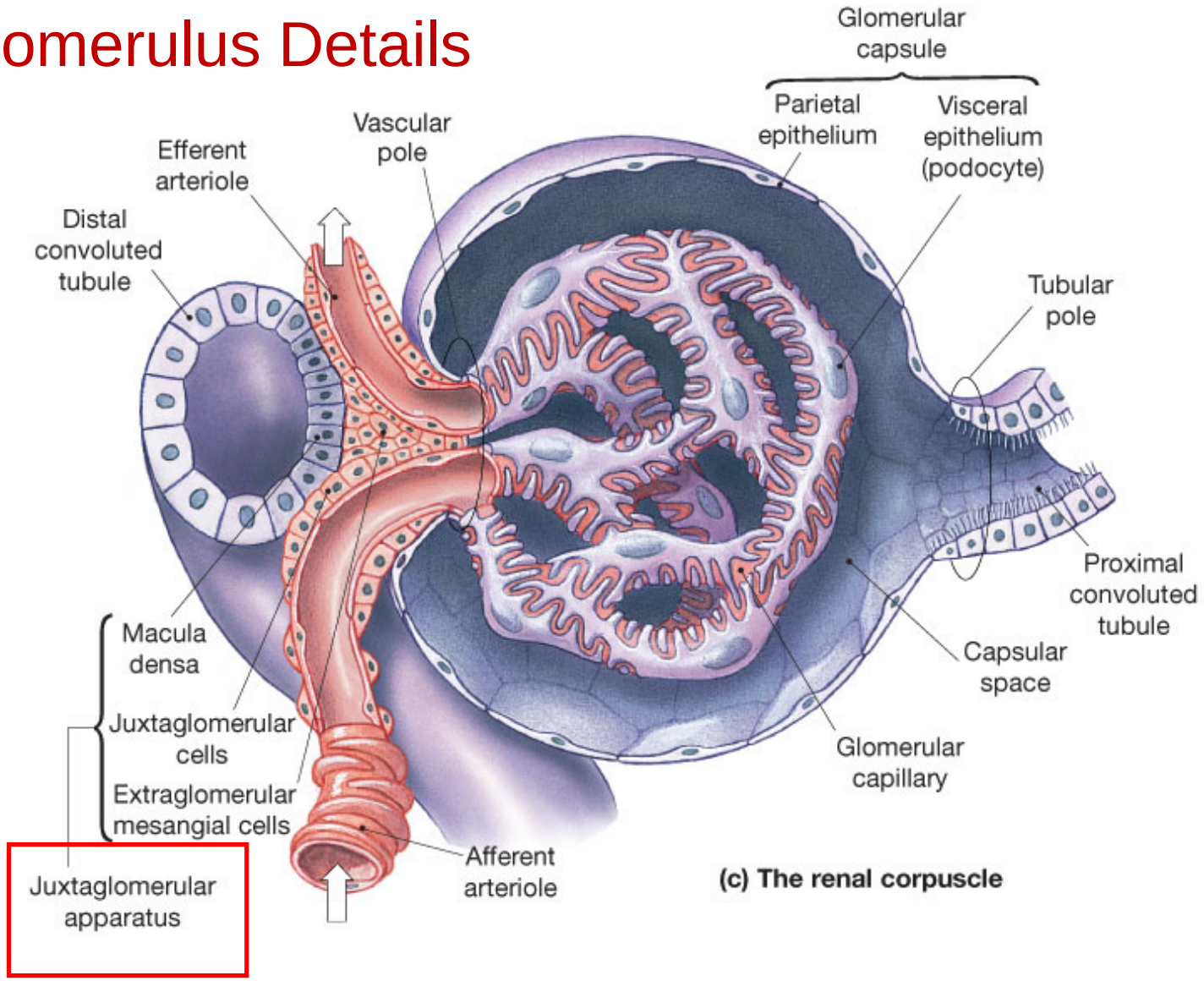
2. Renal Tubule

a) Proximal convoluted tubule (PCT)

b) Loop of Henle (nephron loop)

c) Distal convoluted tubule (DCT)

Glomerulus Details



~85% Cortical Nephrons

Short loop of Henle.

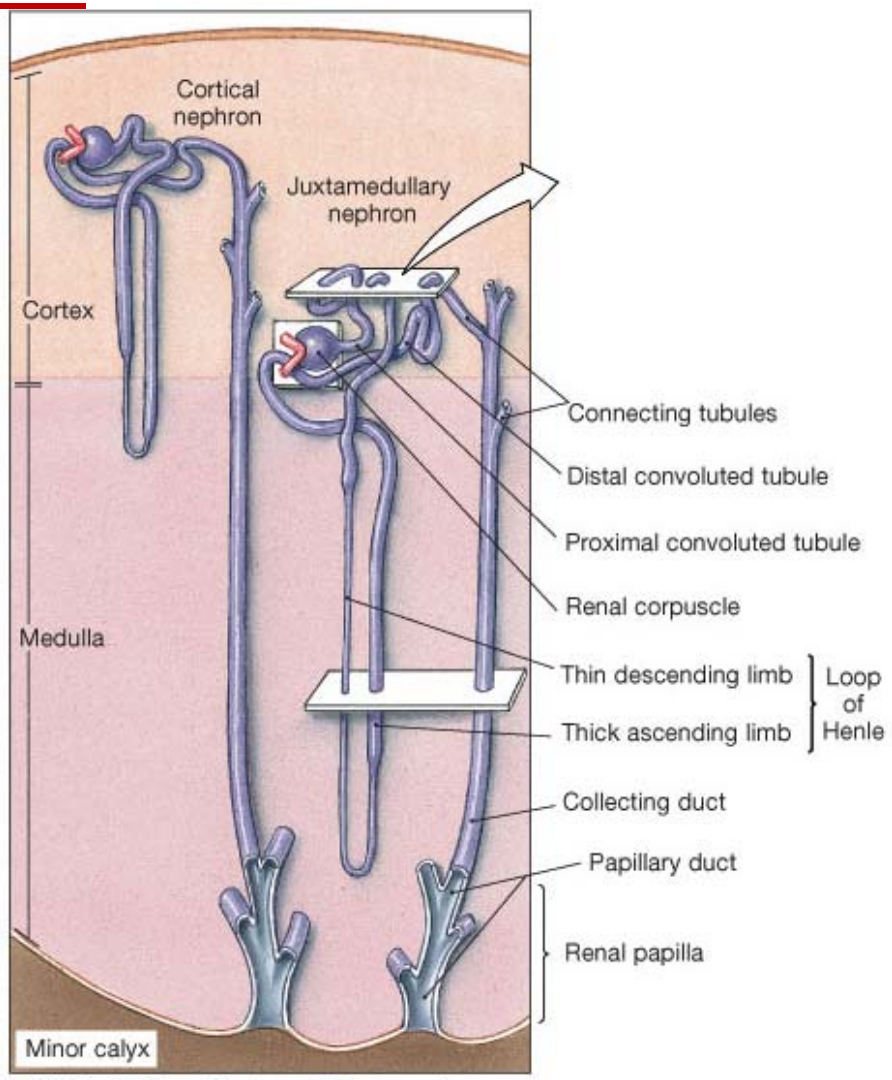
Efferent arteriole becomes peritubular capillaries.

15% Juxtamedullary

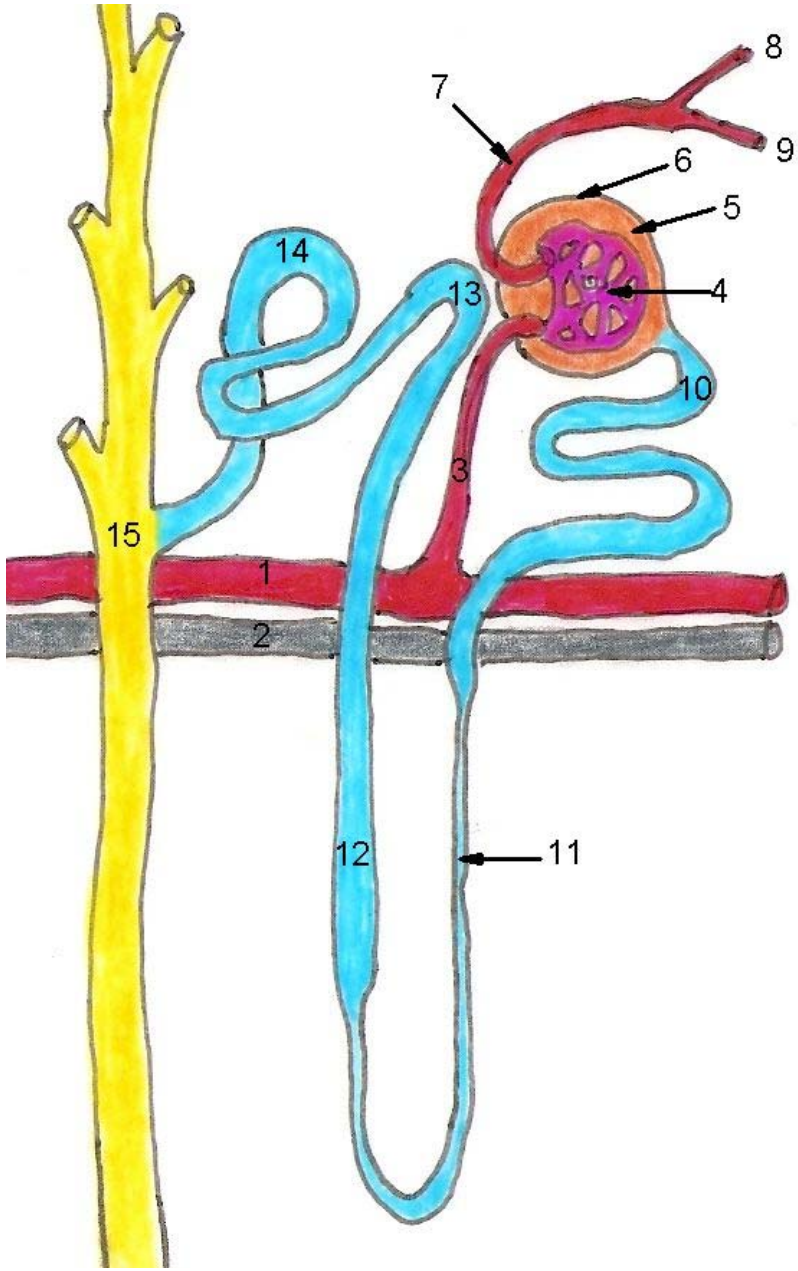
Closer to medulla.

Loop of Henle deeper.

Efferent arteriole becomes vasa recta.



(a) Cortical and juxtamedullary nephrons


8
7
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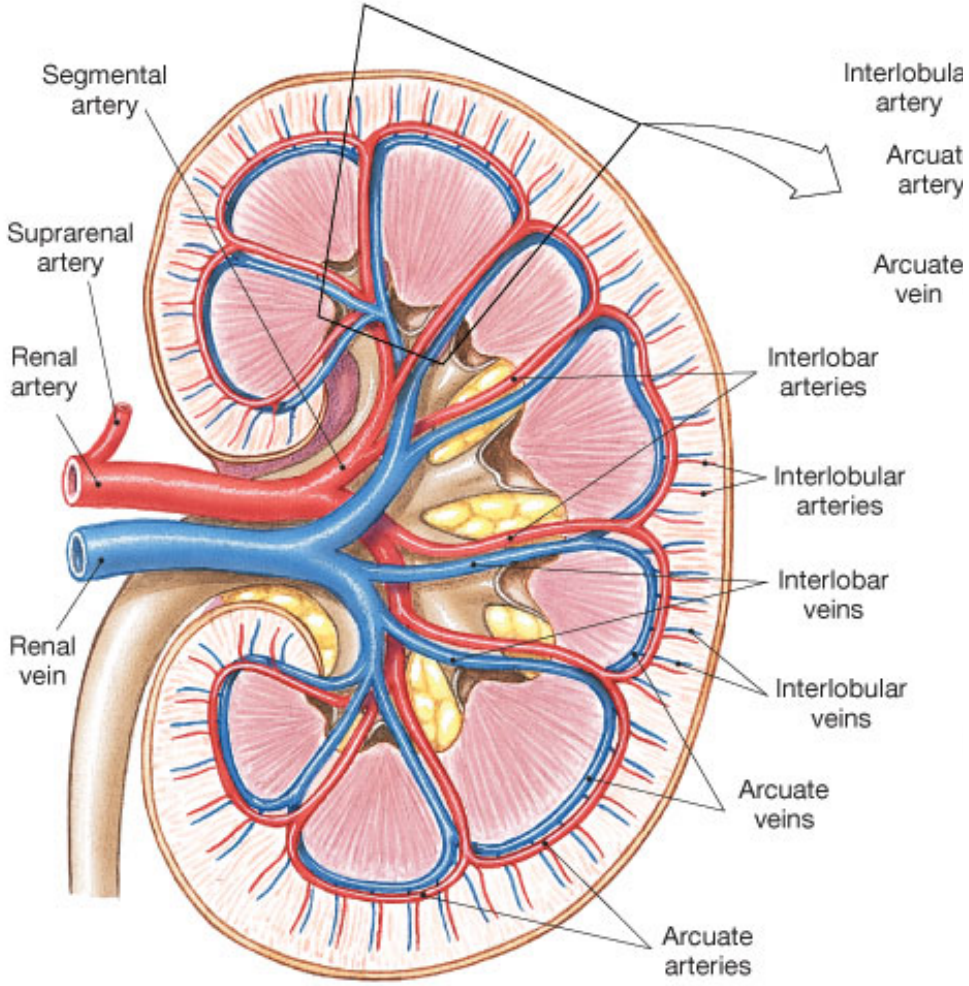
3
15
1
2
12
11

Renal Blood Supply



(a) Frontal section

Renal a.

↓

Segmental a.

↓

Interlobar a.

↓

Arcuate a.

↓

Cortical radiate a.

↓

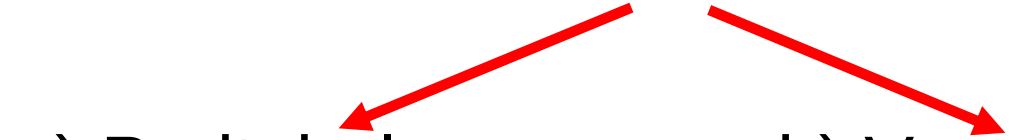
Afferent arteriole

- Blood arrives at afferent arteriole.

Filtrate is “filtered” at Glomerulus.

(a fenestrated capillary bed)

- Blood departs via efferent arteriole.



a) Peritubular capillaries (cortical nephrons)

or

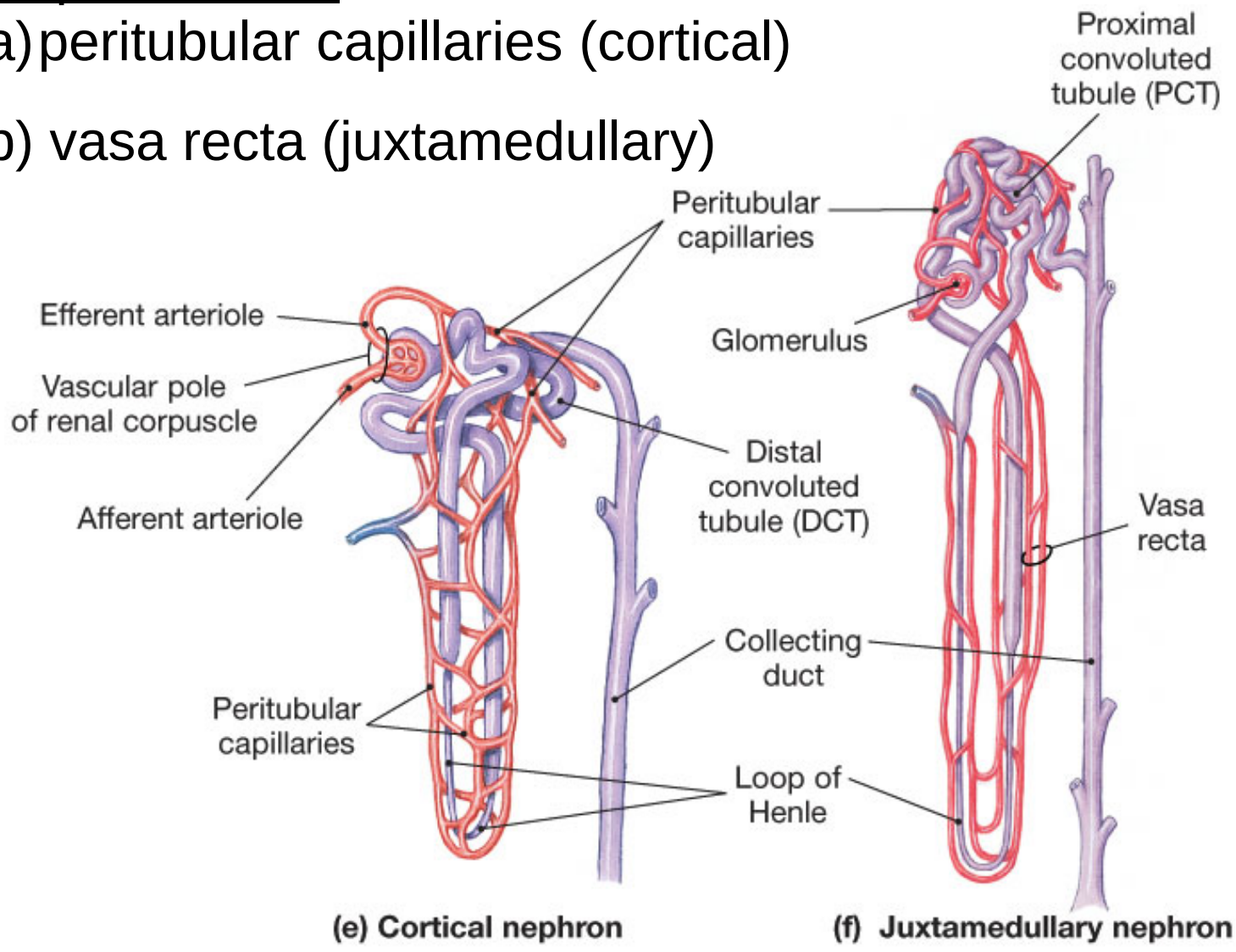
b) Vasa recta capillaries (juxtamedullary nephrons)

Veunles

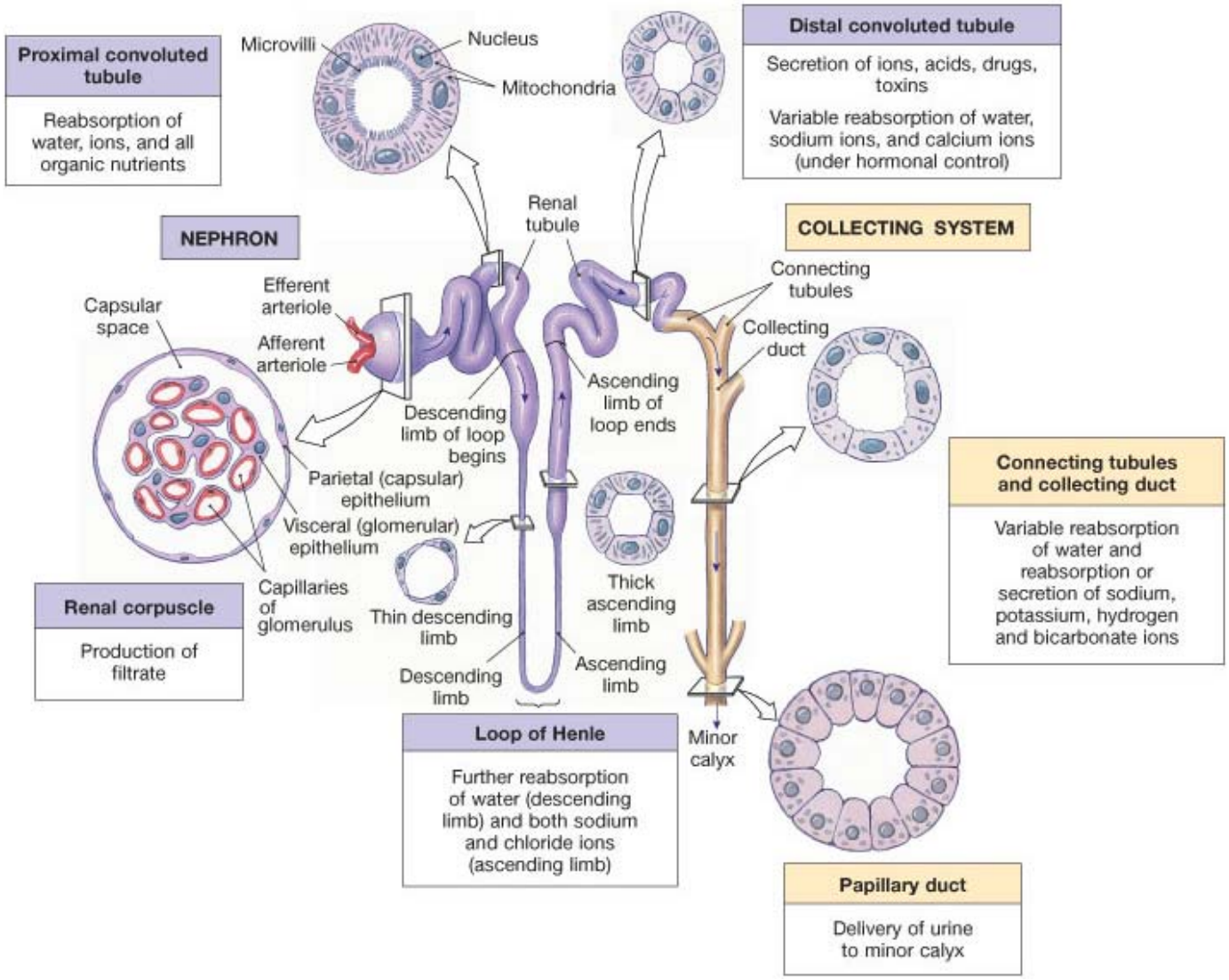
Nephrons with:

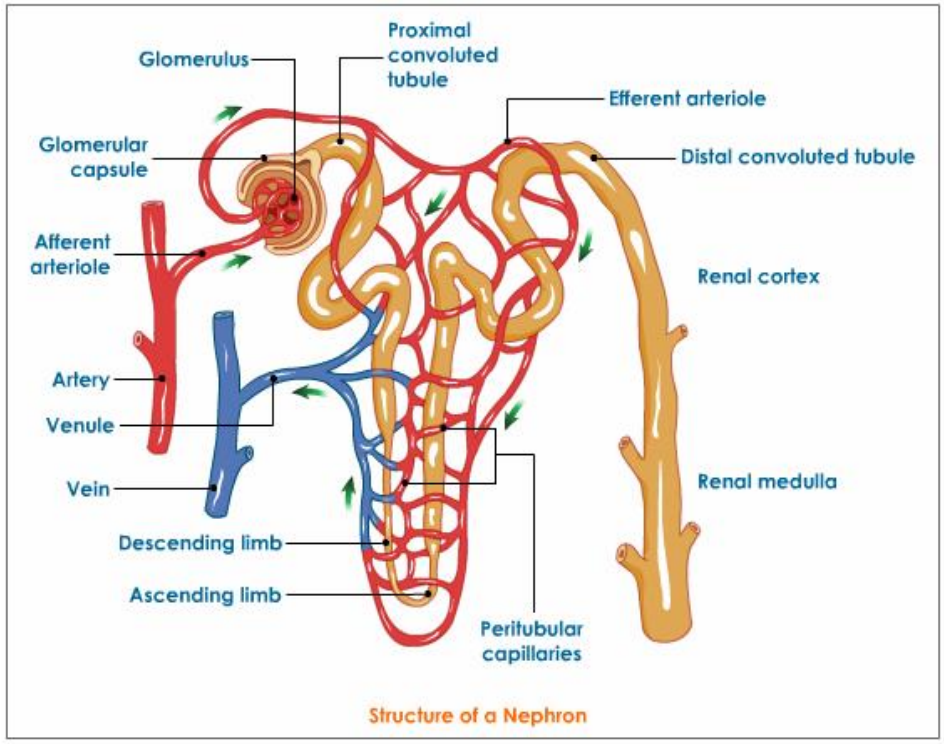
a) peritubular capillaries (cortical)

b) vasa recta (juxtamedullary)



The Renal Tubules





The Renal Tubules

a) Proximal Convoluted Tubule

- Actively reabsorbs most of filtrate
  - Nutrients (glucose, amino acids)
  - Ions (Na^+, Ca^{2+}, etc.)
- Simple cuboidal epi

  With microvilli (brush border) = large surface area

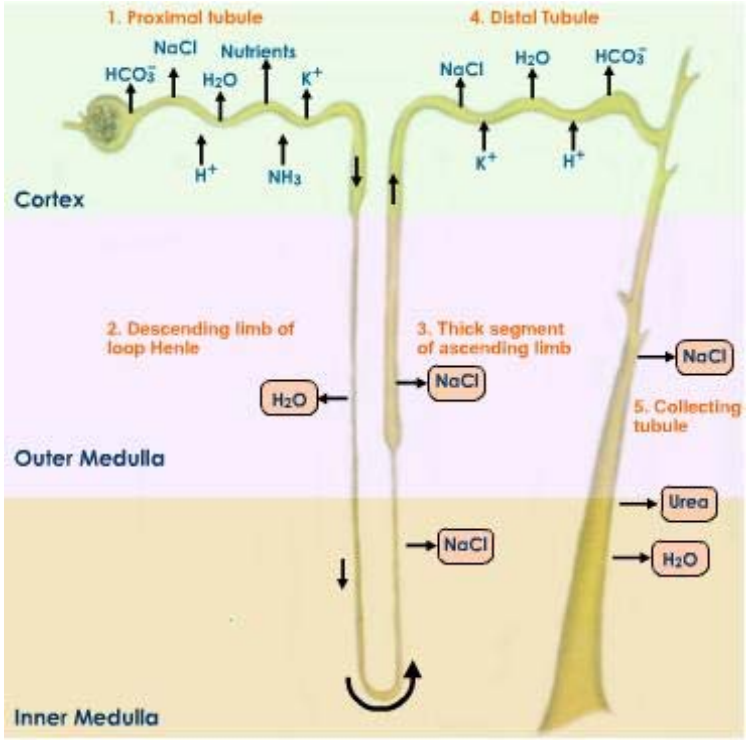
b) Loop of Henle

Descending and Ascending limb

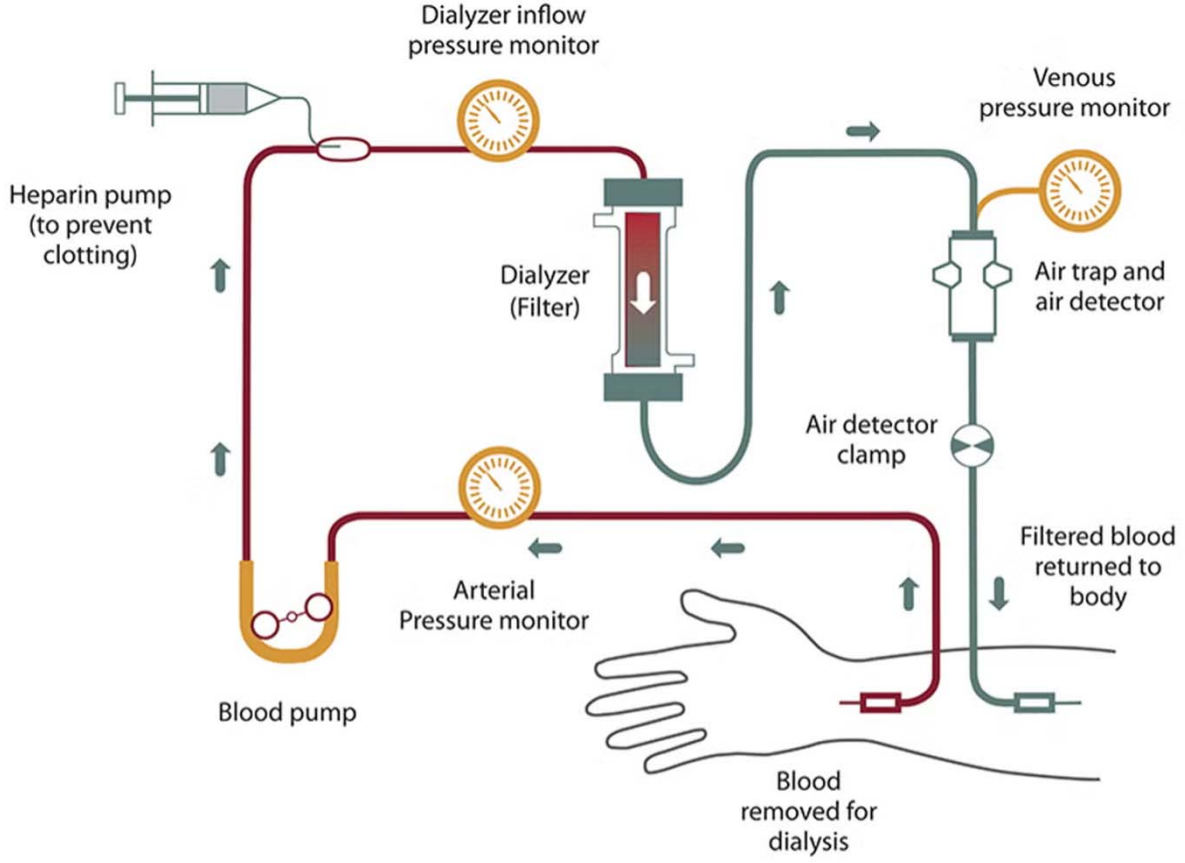
- For Water balance

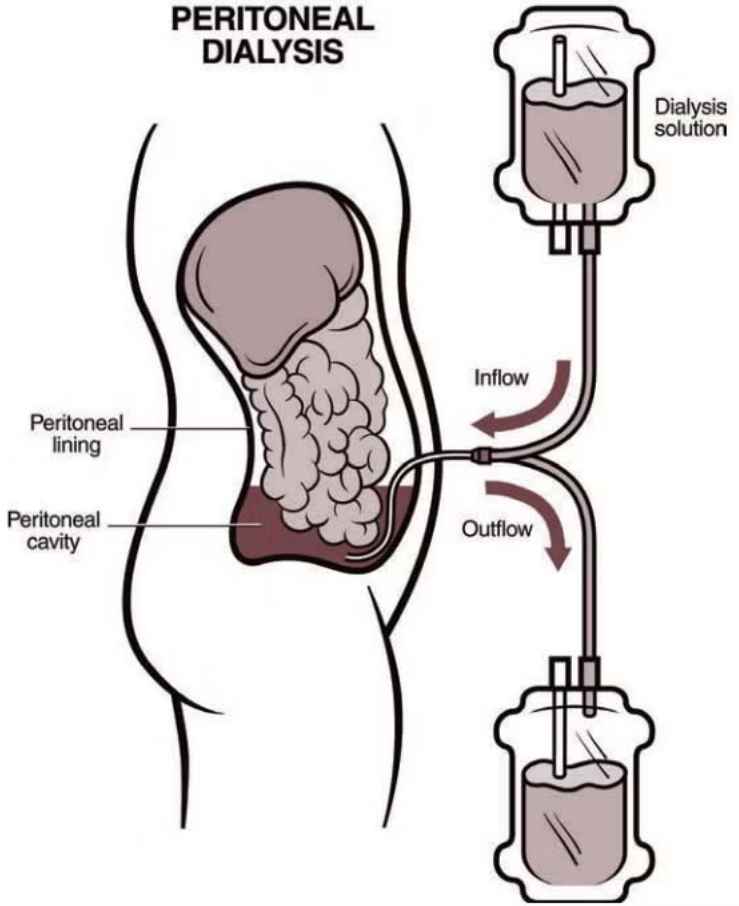
Thin segment - simple squamous epi.

Thick segment - simple cuboidal epi (no microvilli)

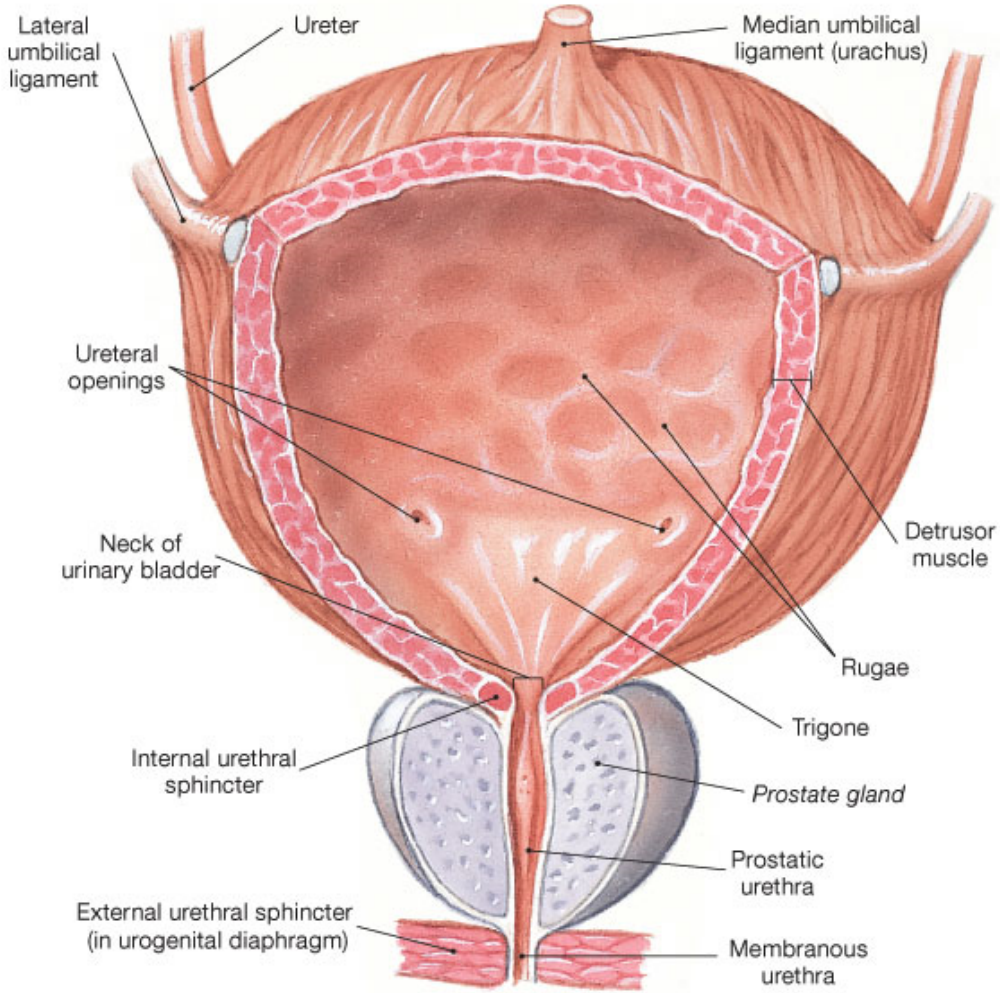


Dialysis

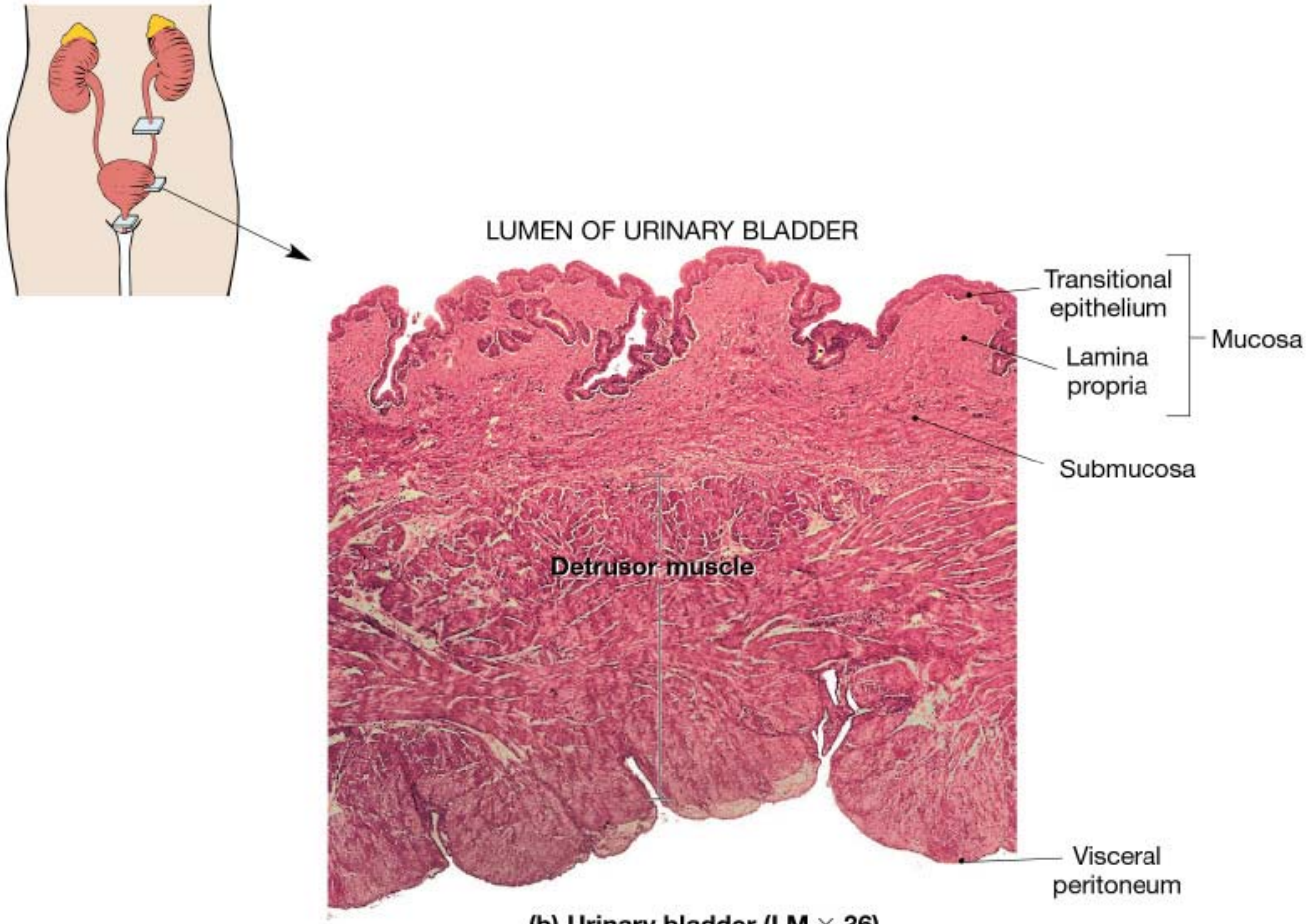

Dialyzer inflow
pressure monitor
Venous
pressure monitor
Heparin pump
(to prevent
clotting)
Dialyzer
(Filter)
Air trap and
air detector
Air detector
clamp
Filtered blood
returned to
body
Arterial
Pressure monitor
Blood pump
Blood
removed for
dialysis


PERITONEAL
DIALYSIS
Dialysis
solution
Inflow
Peritoneal
lining
Peritoneal
cavity
Outflow

Bladder is lined with . . . Transitional epithelium

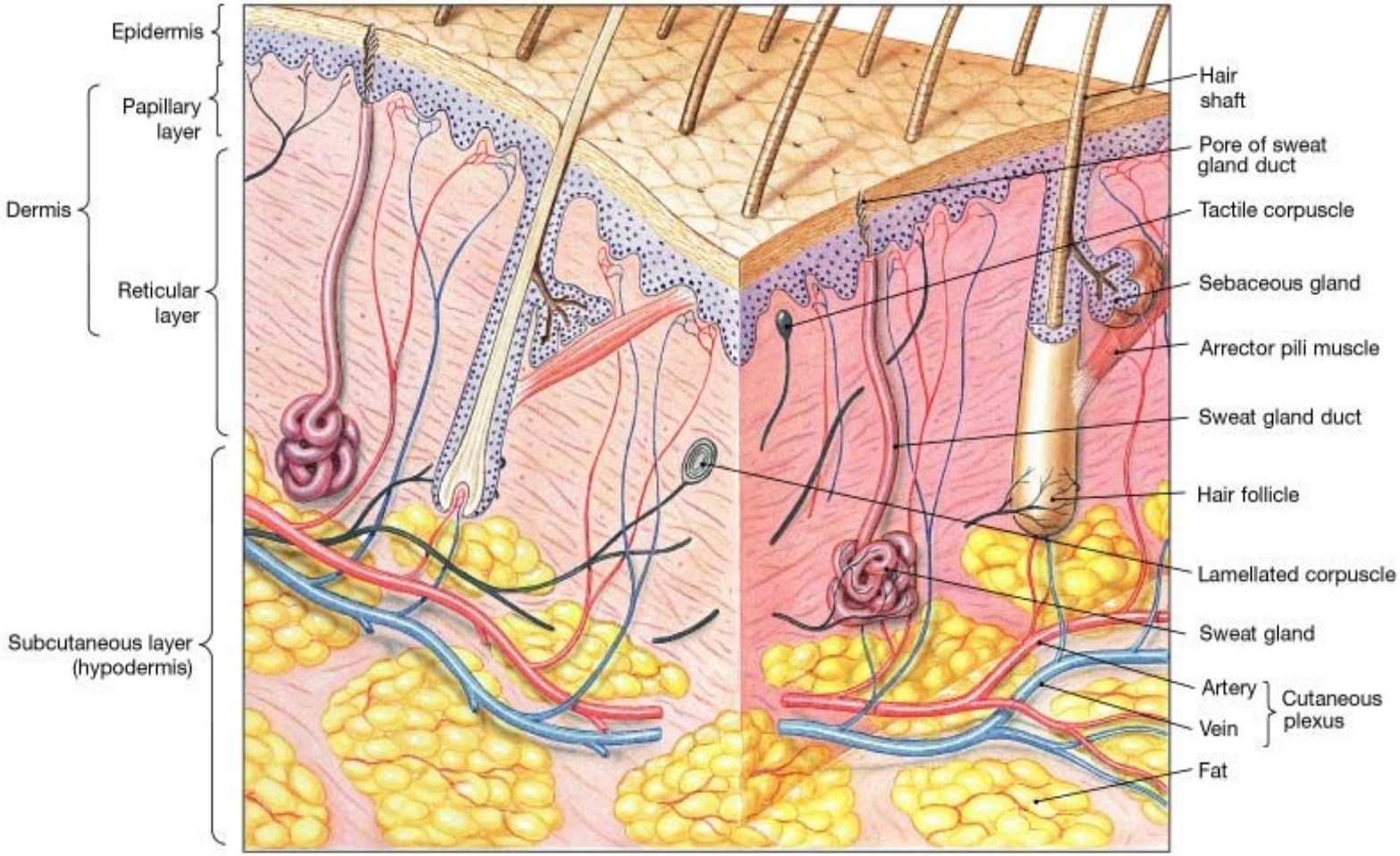


(c) Male bladder, anterior view



(b) Urinary bladder (LM × 36)

The Integumentary System



Functions of the Integumentary System

1) Physical Barrier from Environment

2) Regulation of Body Temperature (T_b)

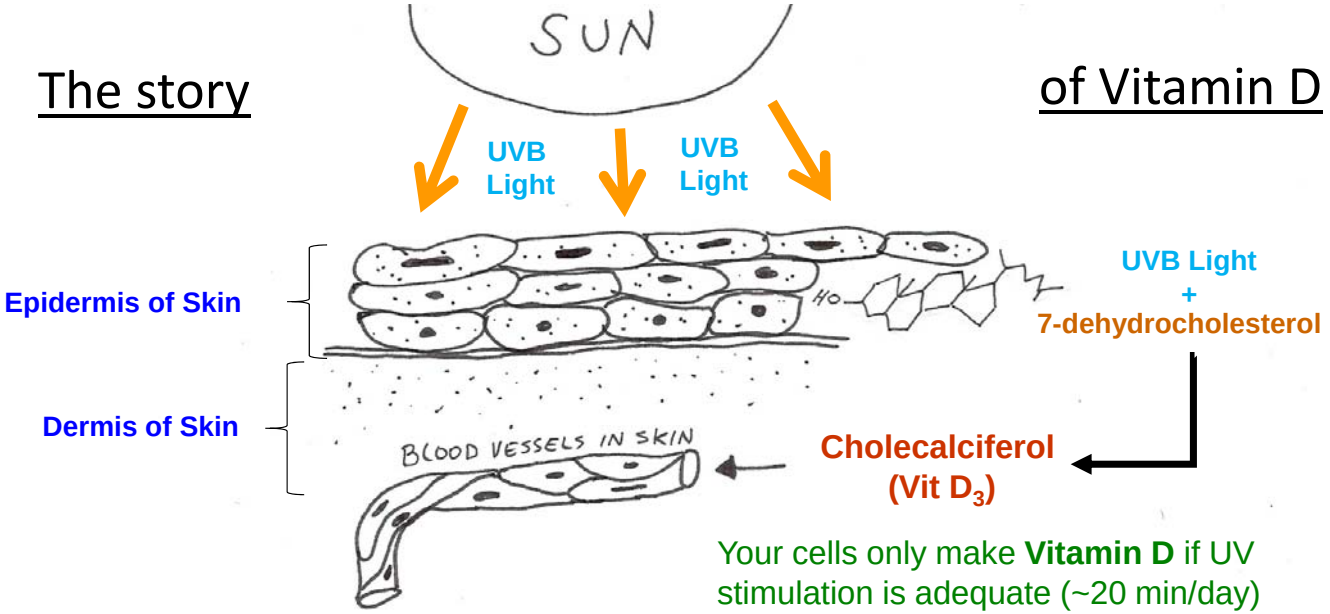
3) Secretions and Excretions

4) Vitamin D Synthesis

5) Sensations (receive sensory info)

6) Immunological Defense

The story of Vitamin D



Your cells only make **Vitamin D** if UV stimulation is adequate (~20 min/day)

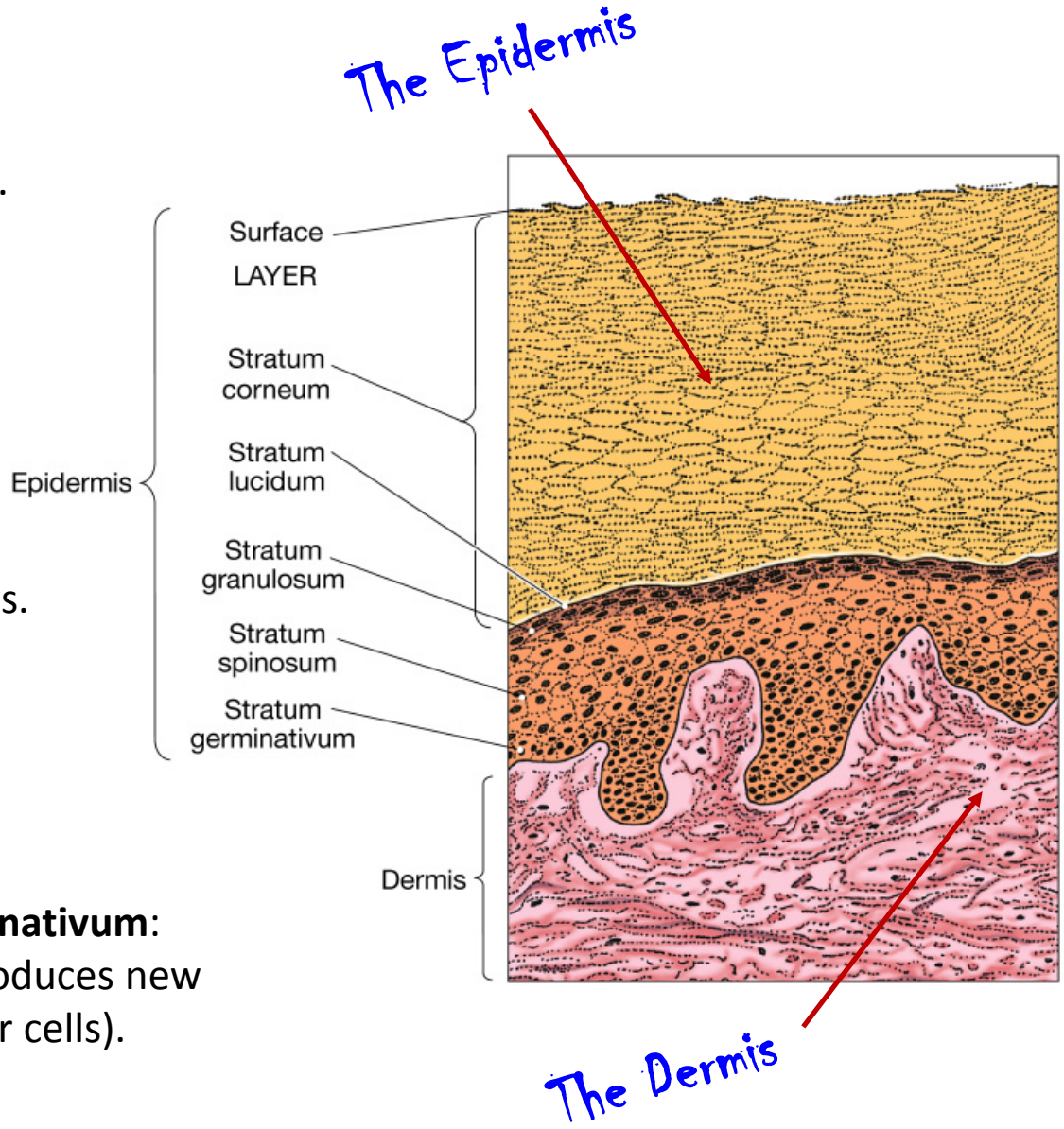
Stratum Corneum:
Most superficial layer,
many layers of dead cells.

Stratum Lucidum:
Translucent layer,
only in thick skin.

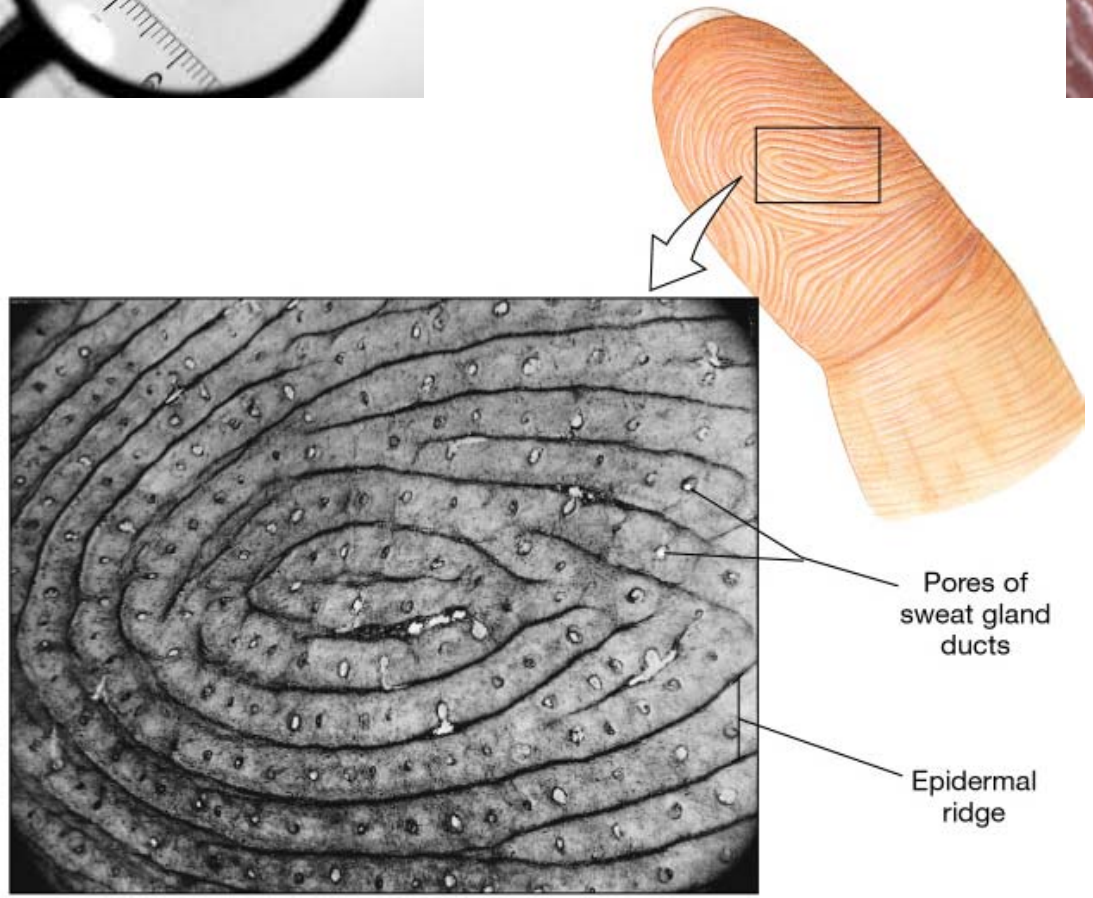
Stratum Granulosum:
Has dark staining granules.

Stratum Spinosum:
Can appear “spiny”.

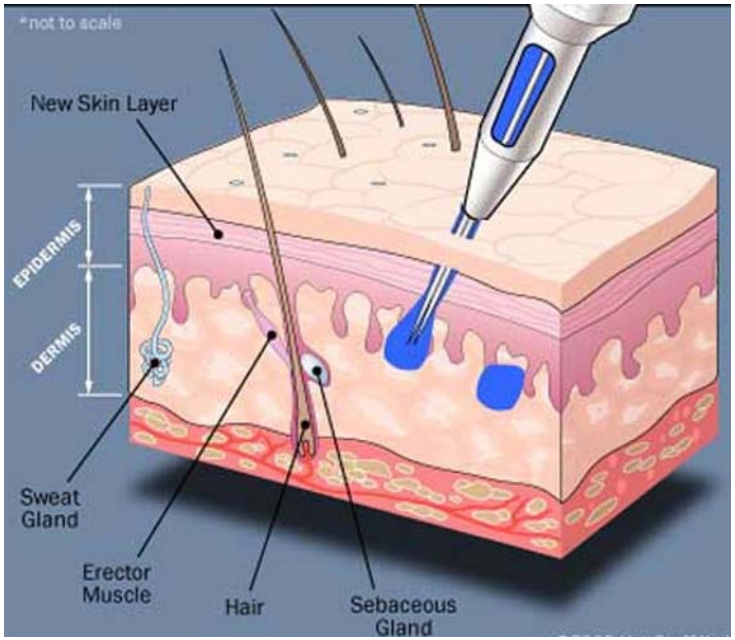
Stratum Basale or Germinativum:
Division of basal cells, produces new keratinocytes (+ the other cells).

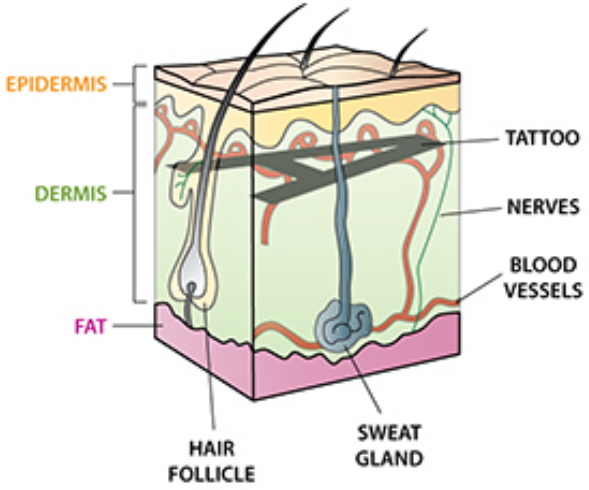


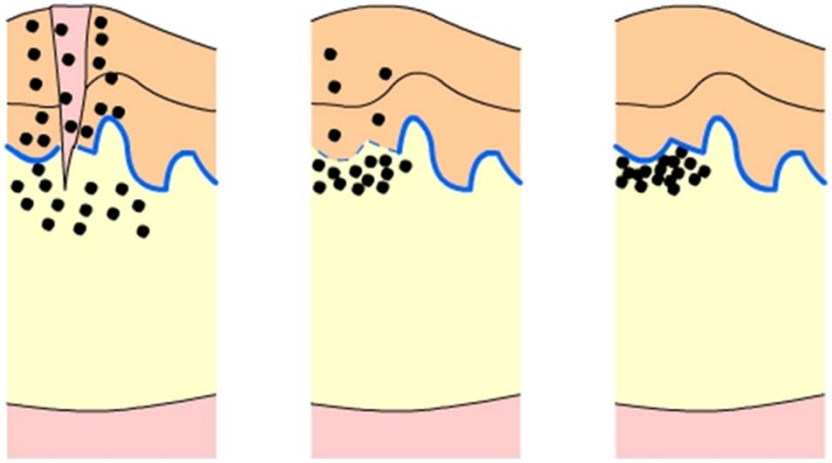
Role of Fingerprints?



Anatomy of a Tattoo


*not to scale
New Skin Layer
EPIDERMIS
DERMIS
Sweat Gland
Erector Muscle
Hair
Sebaceous Gland

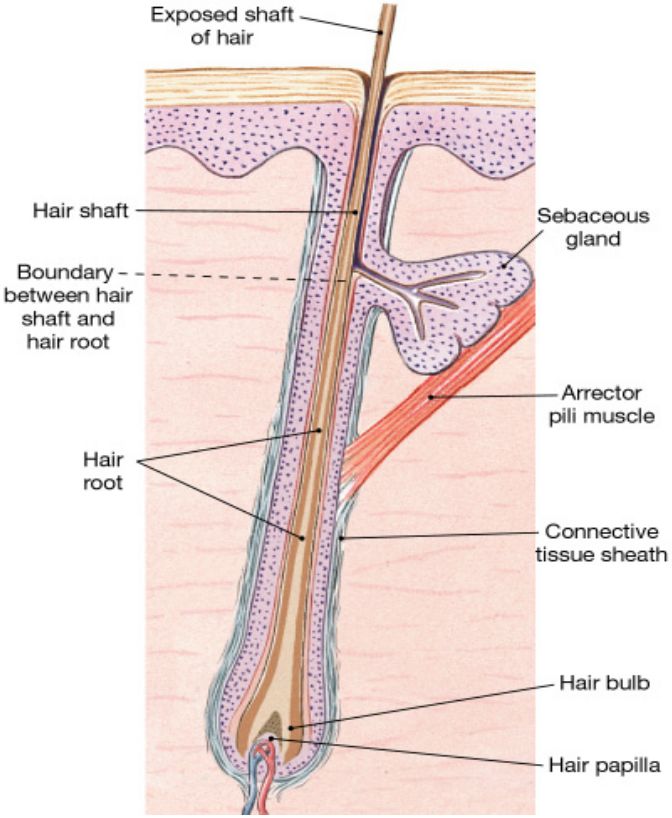

EPIDERMIS
DERMIS
FAT
TATTOO
NERVES
BLOOD VESSELS
HAIR FOLLICLE
SWEAT GLAND


Initial Ink Location
At 1 Month
At 2-3 Months

Accessory Structures of the Skin

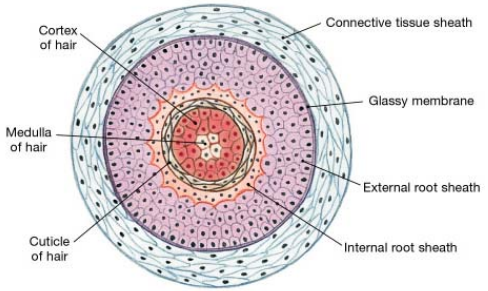
a) Hair
- Shaft
- Root
- Bulb

b) Hair Follicle
- medulla
- cortex



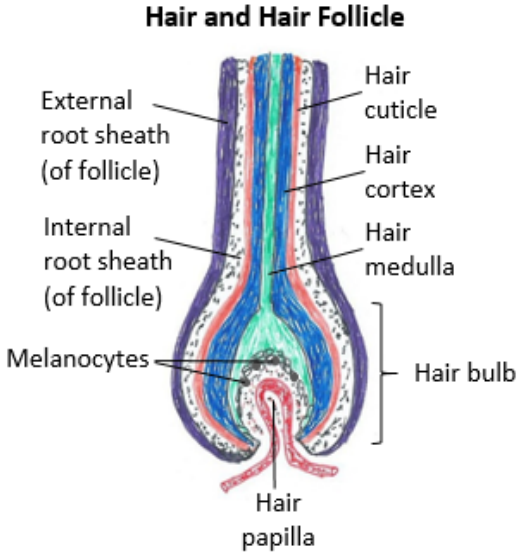
Hair shaft
Longitudinal Section (l.s.)

Hair Root
Cross Section (x.s.)



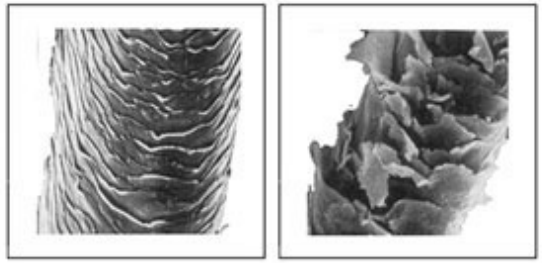
Roles of Hair:
- Protection
- Insulation
- Sensation?

The Hair and the Hair Follicle

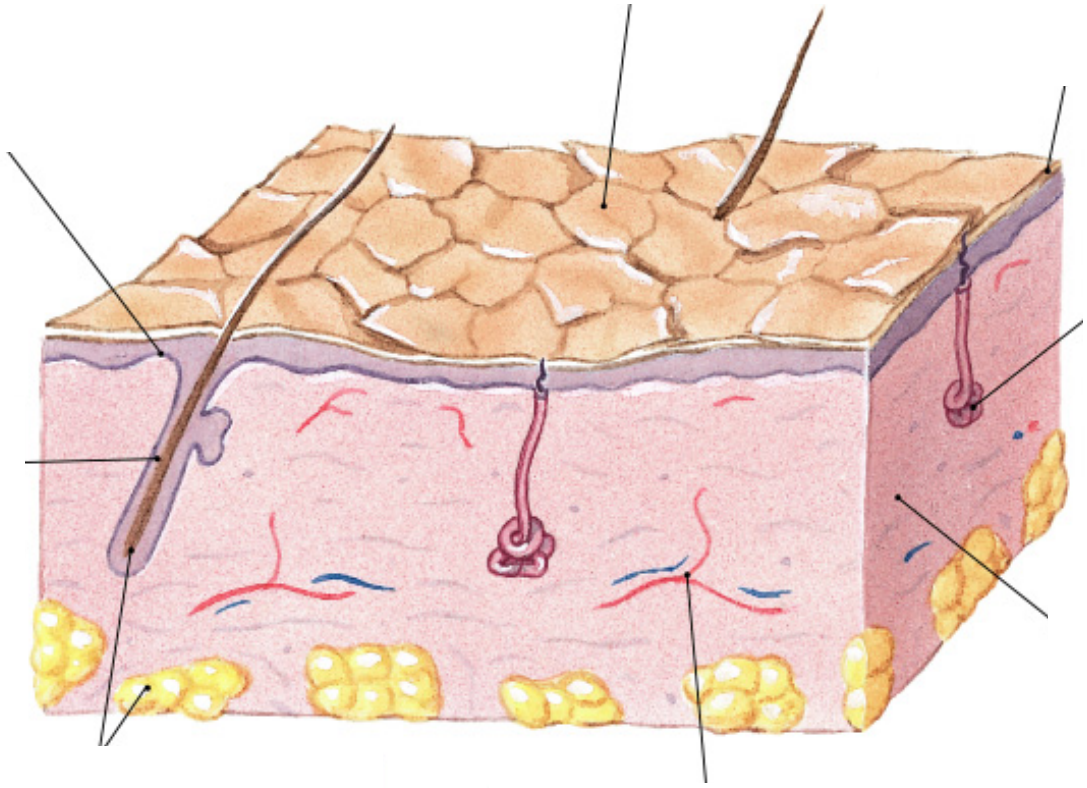


The **Hair shaft** has 3 layers:

- **Medulla** - innermost layer, has large cells.
- **Cortex** - layer between cuticle and medulla, contains keratin and pigment, the bulk of hair.
- **Cuticle** - the outermost layer; transparent and protects the inner layers. A healthy cuticle can give hair a shiny appearance.



Aging of the Integumentary

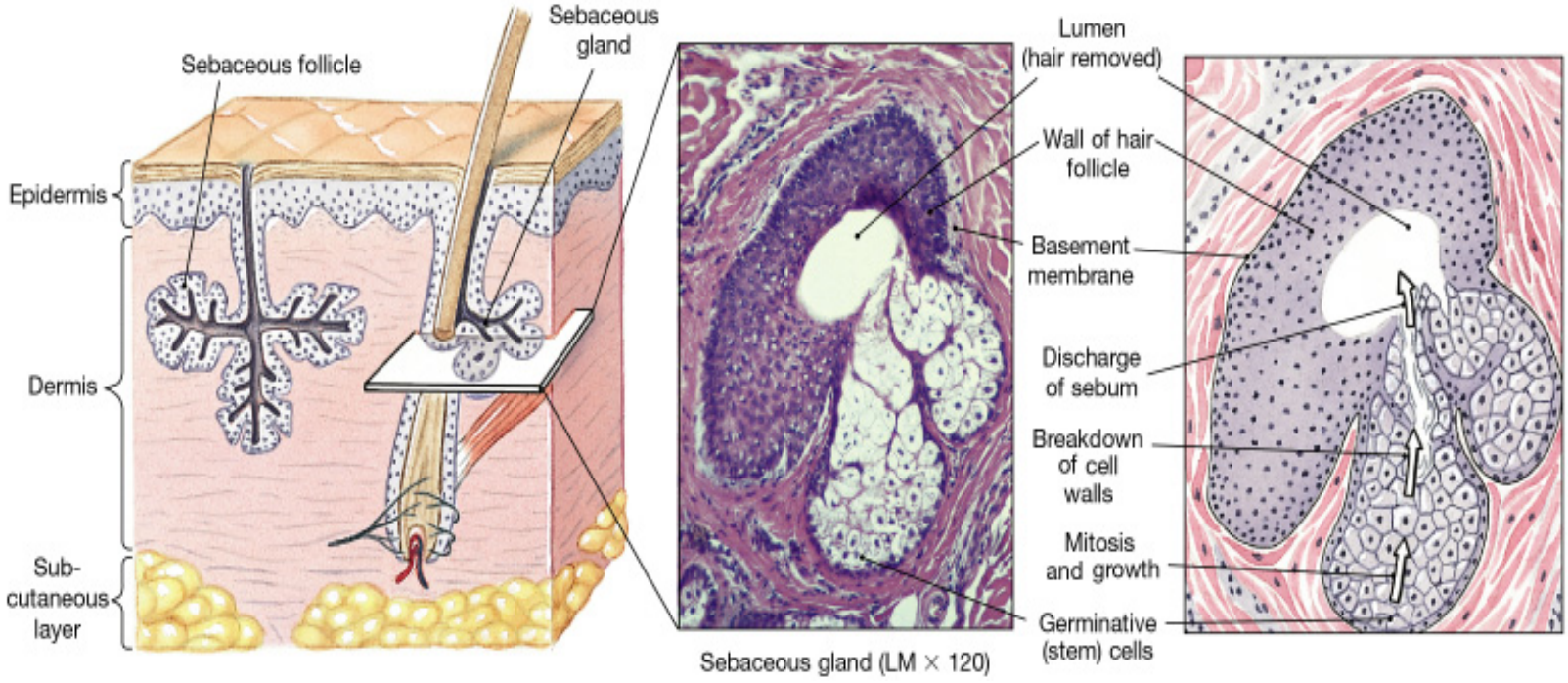


2. Exocrine Glands

Sebaceous (Oil) Glands

- Sebaceous ***Glands*** secret sebum onto hairs.
- Sebaceous ***Follicles*** are large sebaceous glands not associated with hair.

Sebaceous Glands



Sudoriferous (Sweat) Glands

1) Merocrine Sweat Glands

Thin, watery, sensible perspiration, more numerous than apocrine, highest density on palms and soles.

2) Apocrine Sweat Glands

Thicker, lipid rich secretion, only in specific regions of the body, e.g., axillary and inguinal regions.

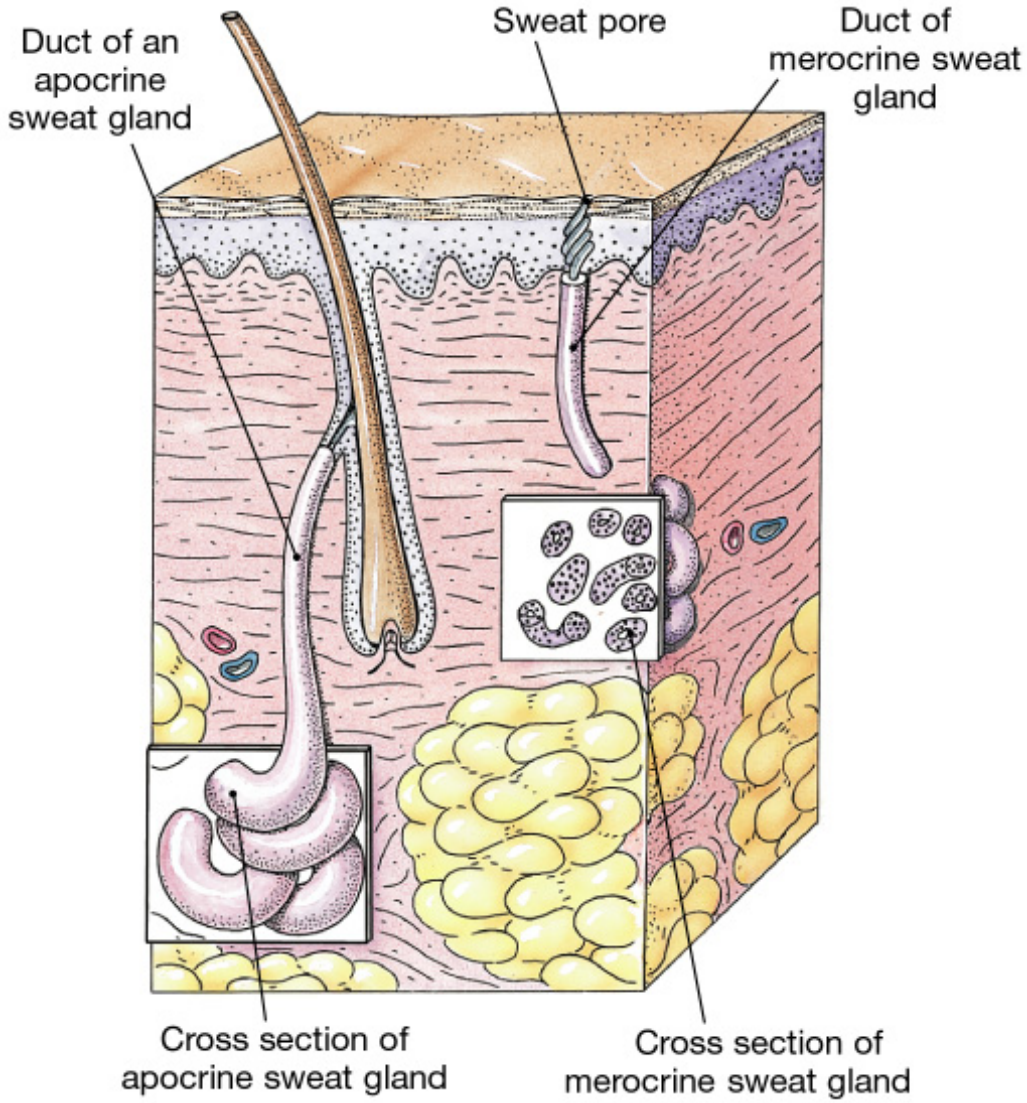
Modified Apocrine Sweat Glands

Mammary Glands

Large, complex apocrine sweat glands, produce milk as nourishment for babies.

Ceruminous Glands

Produces waxy cerumen (ear wax), found in ear canal to keep eardrum protection and pliable.


Duct of an apocrine sweat gland
Sweat pore
Duct of merocrine sweat gland
Cross section of apocrine sweat gland
Cross section of merocrine sweat gland

Sudoriferous (Sweat) Gland