

# 組織學實驗：上皮組織及結締組織

## Histology laboratory :

## Epithelium and connective tissue

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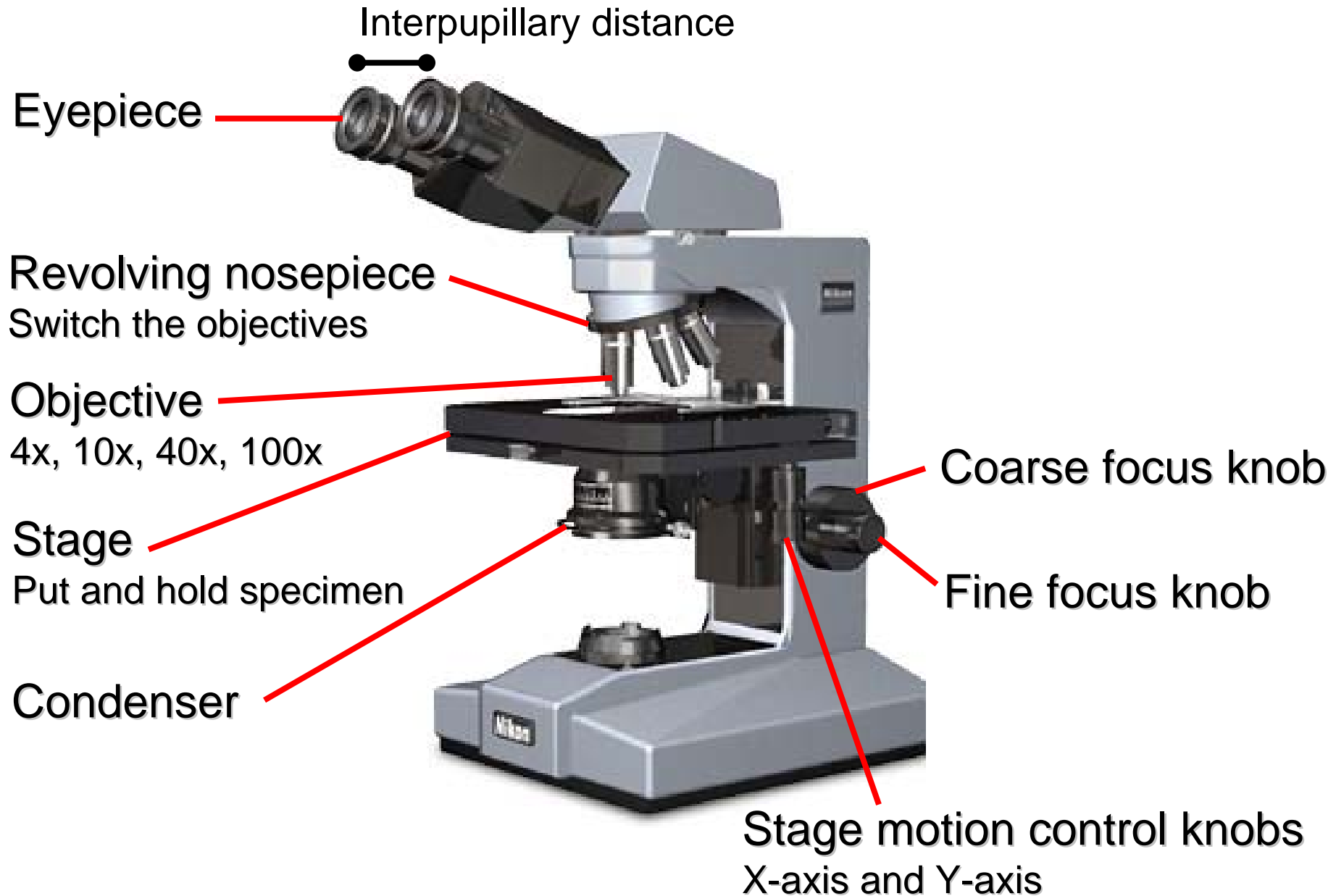
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Please study these slides before coming to the class!

# The microscope



# The use of microscope

1. Set the power switch to “on” and turn the brightness to 7
2. Switch the condenser at the middle position
3. Let 4x objective into position and turn the coarse focus knob to move the stage uppermost (watch the distance between the 4x objective with specimen).
4. Examine the specimen with naked eye, then place the specimen on the stage and use stage motion control knobs to move the specimen into the optical path. Adjust the interpupillary distance so that the left and right viewfields become one.
5. Focus on the specimen with a 4x objective in the first place with the coarse focus knob (the direction which moves the stage from up to down).
6. Then, change the magnification to 10x and 40x objectives by rotating the revolving nosepiece. If focusing is attempted with 40x objective, you must use fine focus knob rather than coarse one.

Note: Never let the 100x objective slip through the specimen

# Before you return the microscope

1. Collect the specimen slides
2. Turn the brightness to 1
3. Set the power switch to “off”
4. Turn 4x objective into the optical path
5. Move the stage to the lowest with coarse focus knob

# Sources of the Pictures & Text

Wheater's Functional Histology (5<sup>th</sup> ed)

B. Young, J. Lowe, A. Stevens & J. Heath

Histology: A Text and Atlas (5<sup>th</sup> ed)

M.H. Ross & W. Pawlina

DiFiore's Atlas of Histology With Functional Correlations

Victor P. Eroschenko

## Photomicrograph Taken by

**Department of anatomy,  
Kaohsiung Medical University**

# Learning Objective

Microscopic structure of Epithelium and Connective tissue by observing following specimens (slides)

- 93W7120, Kidney, H&E
- 93W4875, Trachea and Esophagus, cs, H&E
- 93W3039, Transitional epithelium, H&E
- 93W3240, Mast cell of Mesentery,  $\text{FeCl}_3$ –hematoxylin
- 93W7034, Axillary Skin, H&E

# Learning Objective

- Establish the basic knowledge of connective tissue and distinguish several types of connective tissue and their constituents.
- Epithelium is characterized by close cell apposition and presence of a free surface; try to recognize epithelium and classify several types of them.
- Learn to recognize the appearance of blood vessels, nerve bundles, smooth muscle and skeletal muscle without knowing their structure in detail; their exact structure will be covered in the future.

400X

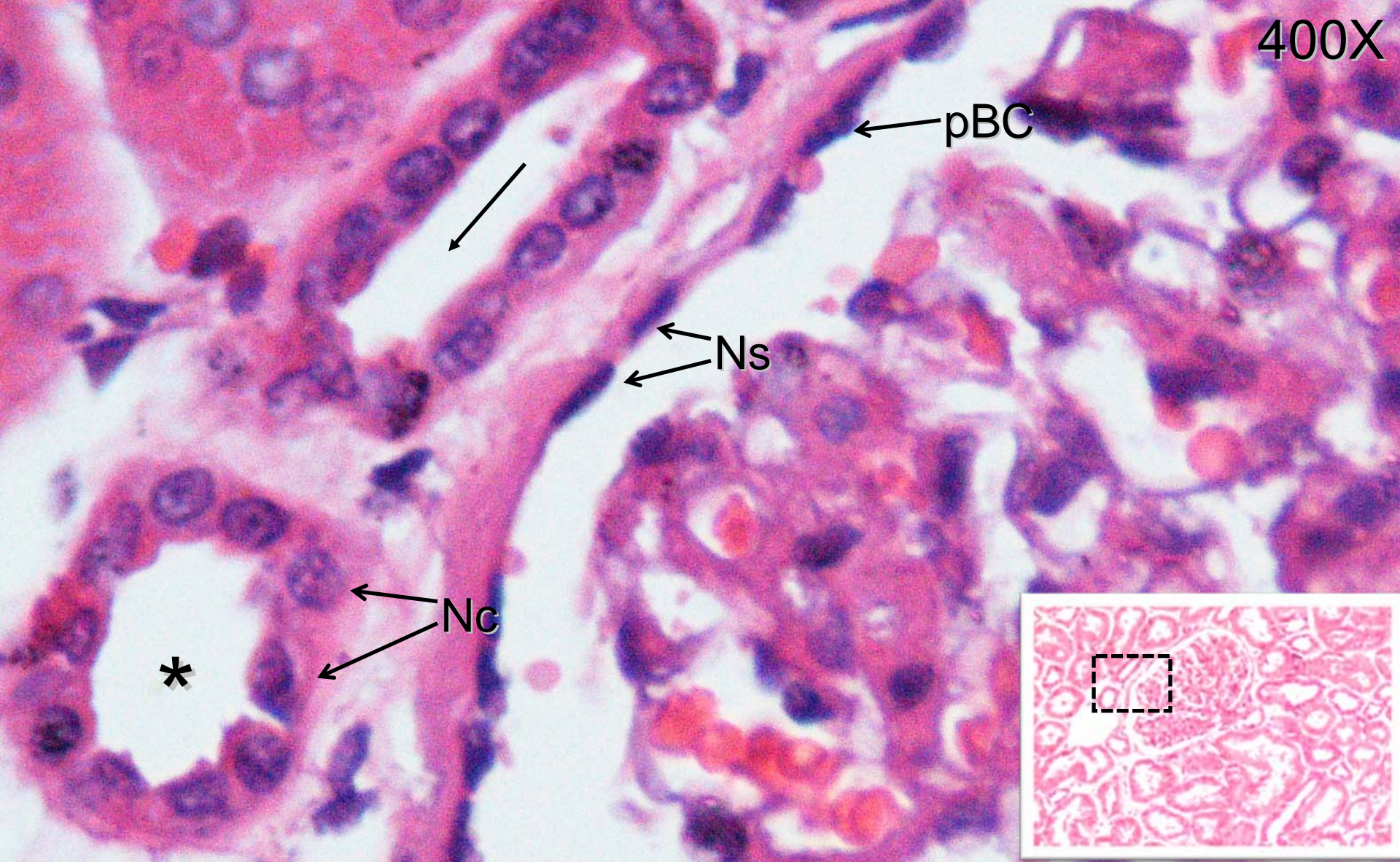


Fig 1. 93W7120  
Kidney, HE.

Ns: Nuclei of squamous epi.

Nc: Nuclei of cuboidal epi.

pBC: parietal layer of Bowman's capsule



**Fig 1. Epithelia in the renal cortex.** This micrograph reveals a sectioned renal corpuscle and adjacent renal tubules. The renal corpuscle consists of a special capillary bed, the glomerulus, and the Bowman's capsule. The parietal layer of Bowman's capsule (pBC) composed of **simple squamous epithelium**. The epithelial cells are very flat, as judged by the shape of their nuclei. Note that cell boundaries are not evident and the nuclei are unevenly spaced. The uneven spacing is because the sectioning knife passes through some cells without including the nucleus. The cross-sectioned (cs), marked with asterisks (\*), and longitudinal-sectioned (ls), marked with arrow (→), of renal tubules provide good examples of a **simple cuboidal epithelium**; note that cell width approximates cell height. Although the boundaries between individual cells are distinct, the nuclear shape provides an approximate indication of the cell size and shape.

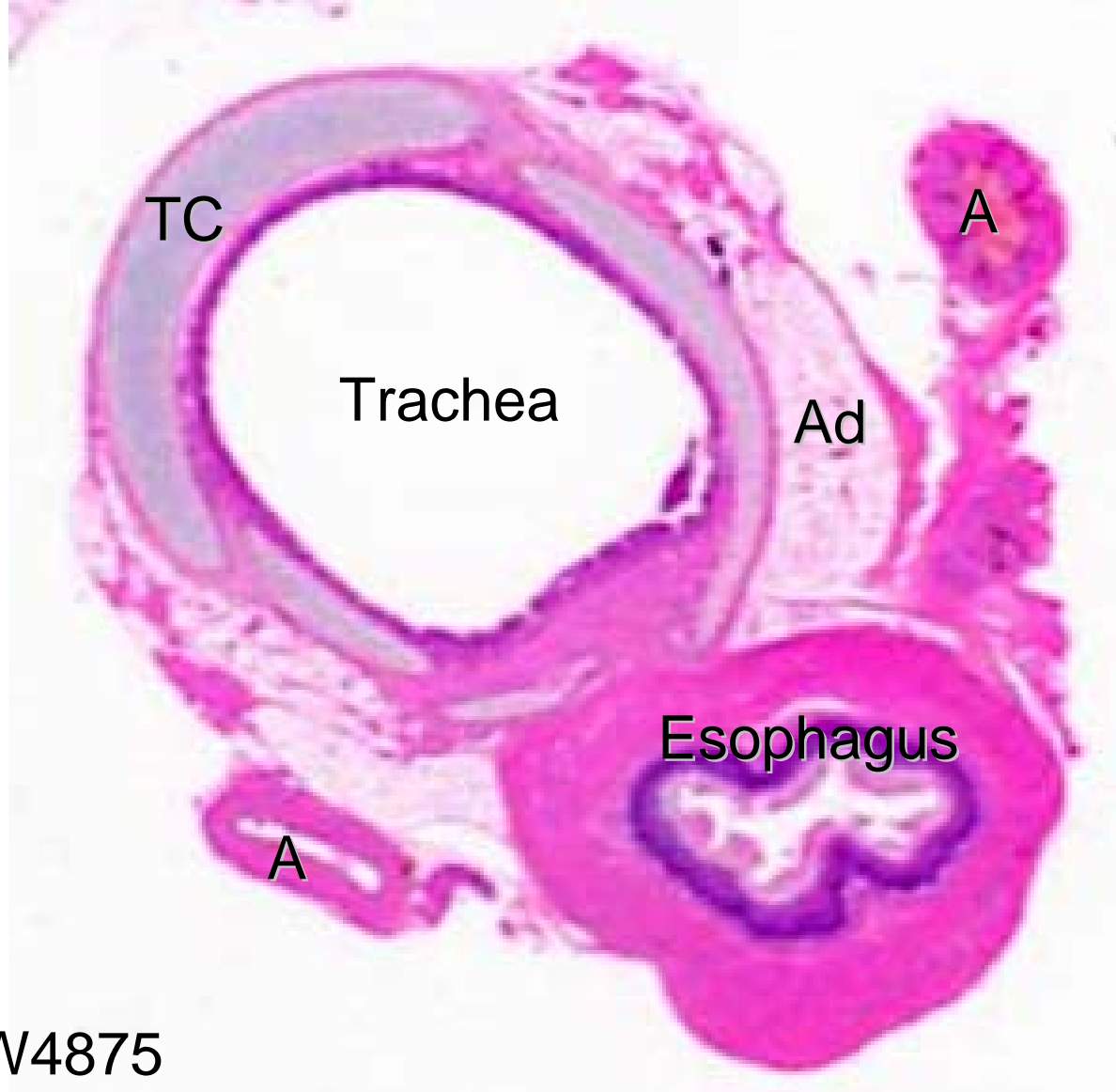


Fig 2. 93W4875

Trachea and esophagus, H&E

TC: Tracheal cartilage

Ad: Adipose tissue

A: Artery

**Fig 2. 93W4875 Trachea and esophagus, H&E.** This specimen shows the relationship between the trachea and the esophagus from an unknown animal. To observe this slide with naked eye first, you could distinguish the trachea from the esophagus. The trachea has a ring appearance because of the C-shaped tracheal cartilage (TC), which keeps the trachea patent. The esophagus has a muscular wall and an irregular appearance lumen. A significant amount of adipose tissue (Ad) is found around the trachea and the esophagus. And there are two large arteries (A) adjacent to the adipose tissue (your slides may contain lymph nodules). Next, you should observe **the lining of the trachea and the esophagus** with the microscopy individually.

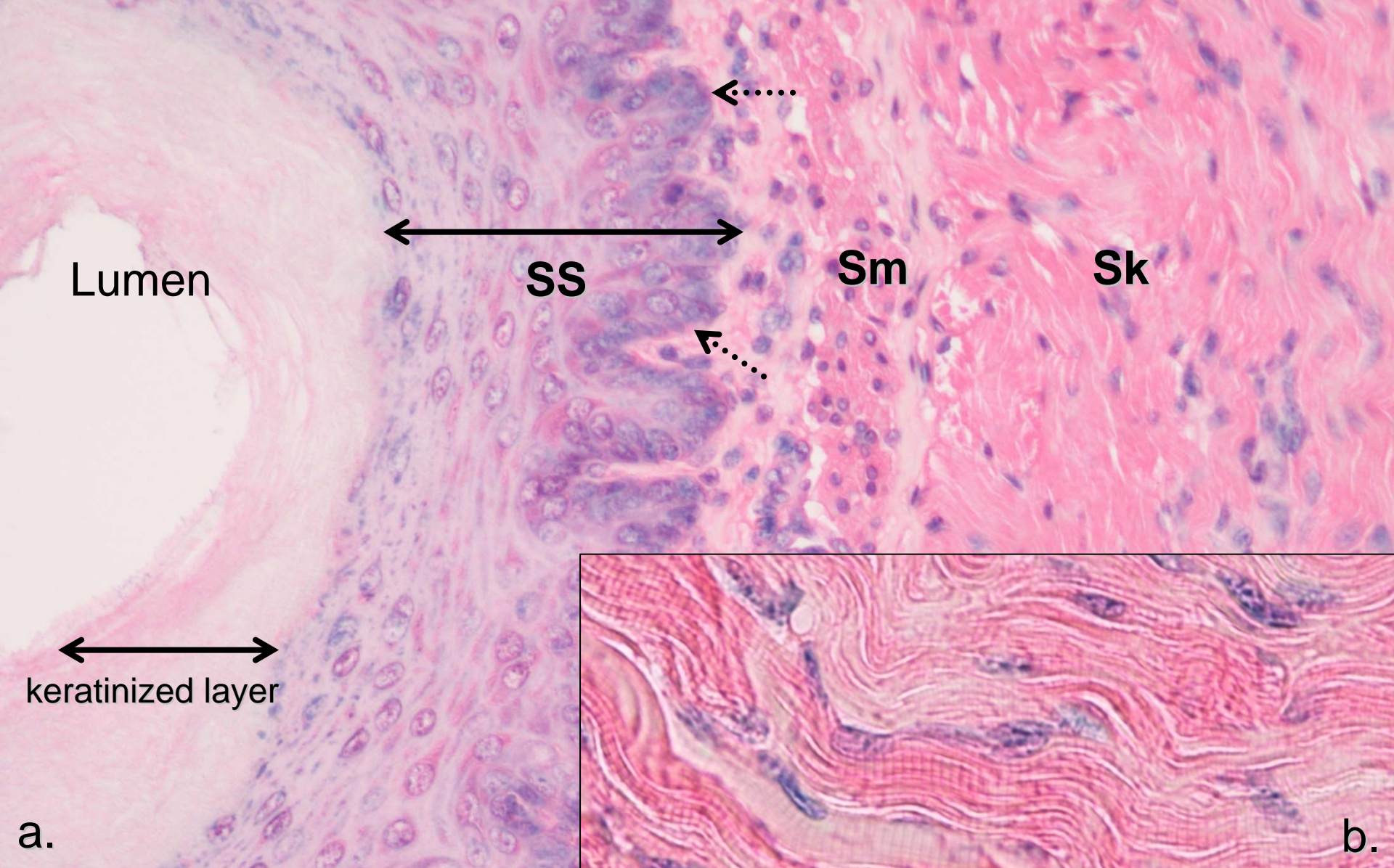


Fig 3. 93W4875  
Trachea and **Esophagus.**

SS: Stratified squamous epi.  
Sm: Smooth muscle (cs)  
Sk: Skeletal muscle (ls)

### **Fig 3. The microscopic structure of esophagus.**

The lining of the esophagus consists of more than one layer of cells, and the surface layer consists of flat or squamous cell. It's a good example of **stratified squamous epithelium** (SS). In a stratified epithelium, the shape and height of the cells usually vary from layer to layer, but only the shape of the cells that form the surface layer is used in classifying the epithelium. The wall of the esophagus contains the smooth muscle and the skeletal muscle. You could try to discriminate smooth muscle (cross-sectioned in this micrograph) from skeletal muscle (longitudinal-sectioned in this micrograph) at low-magnification immediately. By the way, the cross-striation of the skeletal muscle appear at higher magnification in Fig 5b.

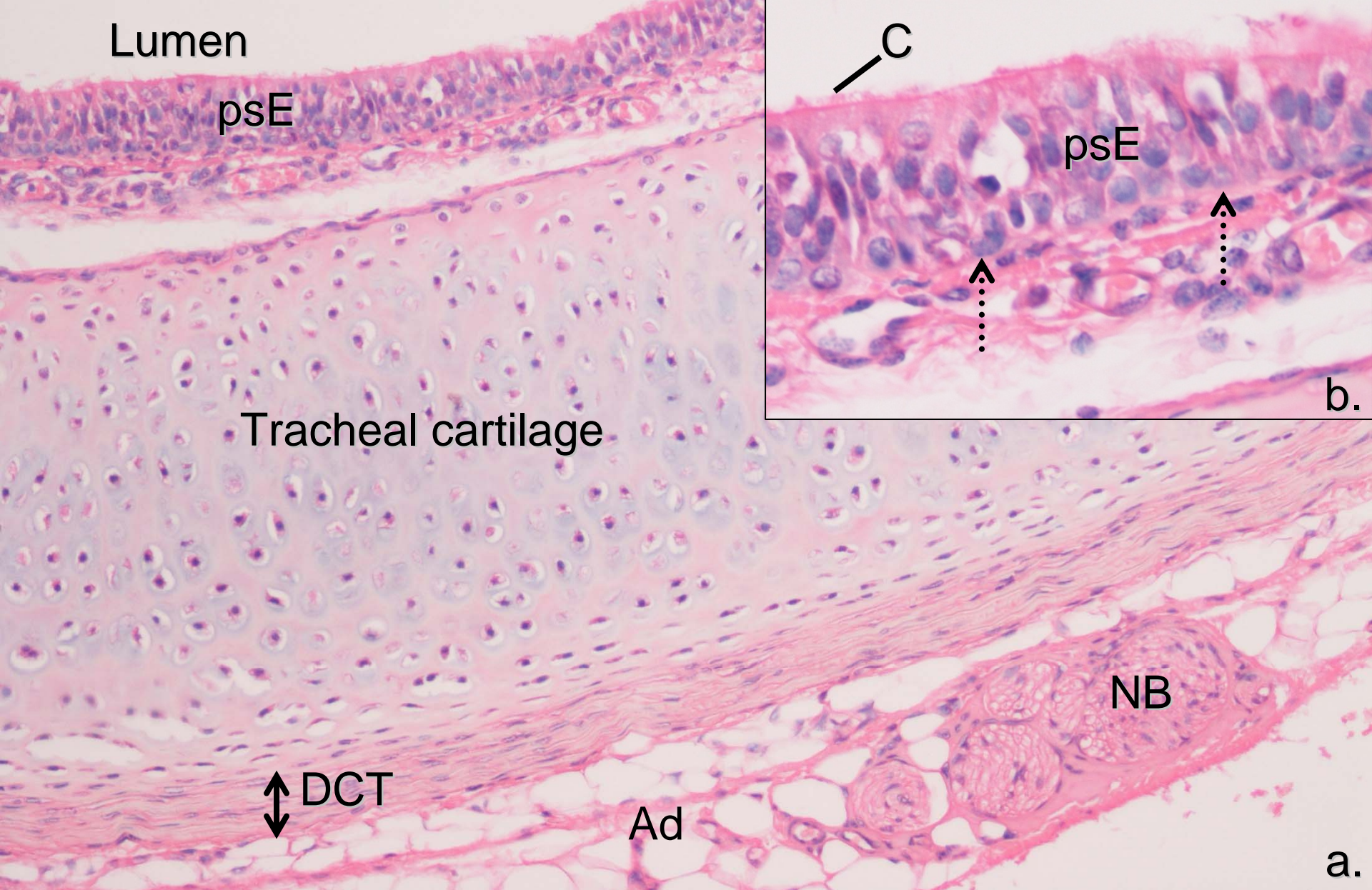


Fig 4. 93W4875  
**Trachea** and esophagus

psE: Pseudostratified ciliated columnar epi.  
C: Cilia      DCT: Dense connective tissue  
Ad: Adipose tissue      NB: Nerve fiber bundle

## **Fig 4. The microscopic structure of trachea.**

The lining of the trachea consists of **pseudostratified ciliated columnar epithelium**. Although the epithelium appears to form the stratified, but all the cells rest on the basement membrane. The wall of the trachea contains the C-shaped tracheal cartilage. Besides, the tracheal cartilage is surrounded by the regular dense regular connective tissue (DCT). The collagen fibers are arranged in a regular manner and the fibroblast nuclei are elongated in the direction of the collagen fibers. By the way, adipose tissue (Ad) and nerve fiber bundles (NB) could be seen in this micrograph. Pseudostratified ciliated columnar epithelium appears at higher magnification in Fig 6b, and the cilia (C) is well demonstrated in this figure.

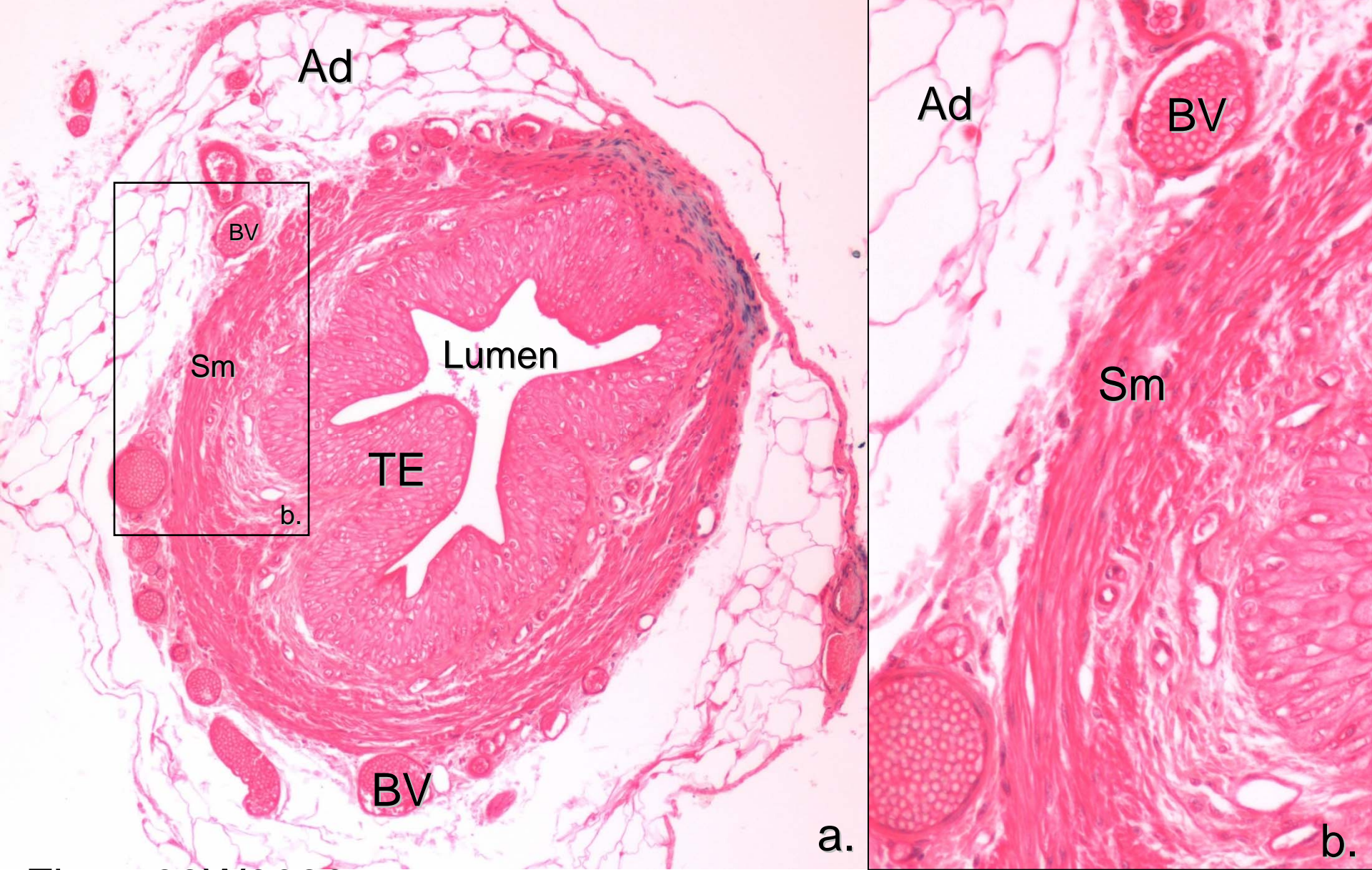


Fig 5. 93W3039  
Transitional epithelium,  
H&E.

TE: Transitional epi. Ad: Adipose tissue  
Sm: Smooth muscle BV: Blood vessel



**Fig 5. 93W3039 Transitional epithelium, H&E.** This micrograph is taken from the cross-sectioned ureter. The lumen of the ureter is lined by transitional epithelium (TE). The ureters are muscular tubes that carry urine from the kidneys to the bladder. The wall of the ureter contains smooth muscle (Sm). Because of contraction of the smooth muscle, the luminal surface is characteristically folded, thus creating a star-like lumen. Surrounding the muscular wall is a loose connective tissue containing adipose tissue (Ad) and blood vessels (BV). The wall of the ureter in the rectangular area in Fig 7a is examined at higher magnification as in Fig 7b. Adipose tissue (Ad), smooth muscle (Sm) and blood vessels (BV) could be seen in this micrograph.

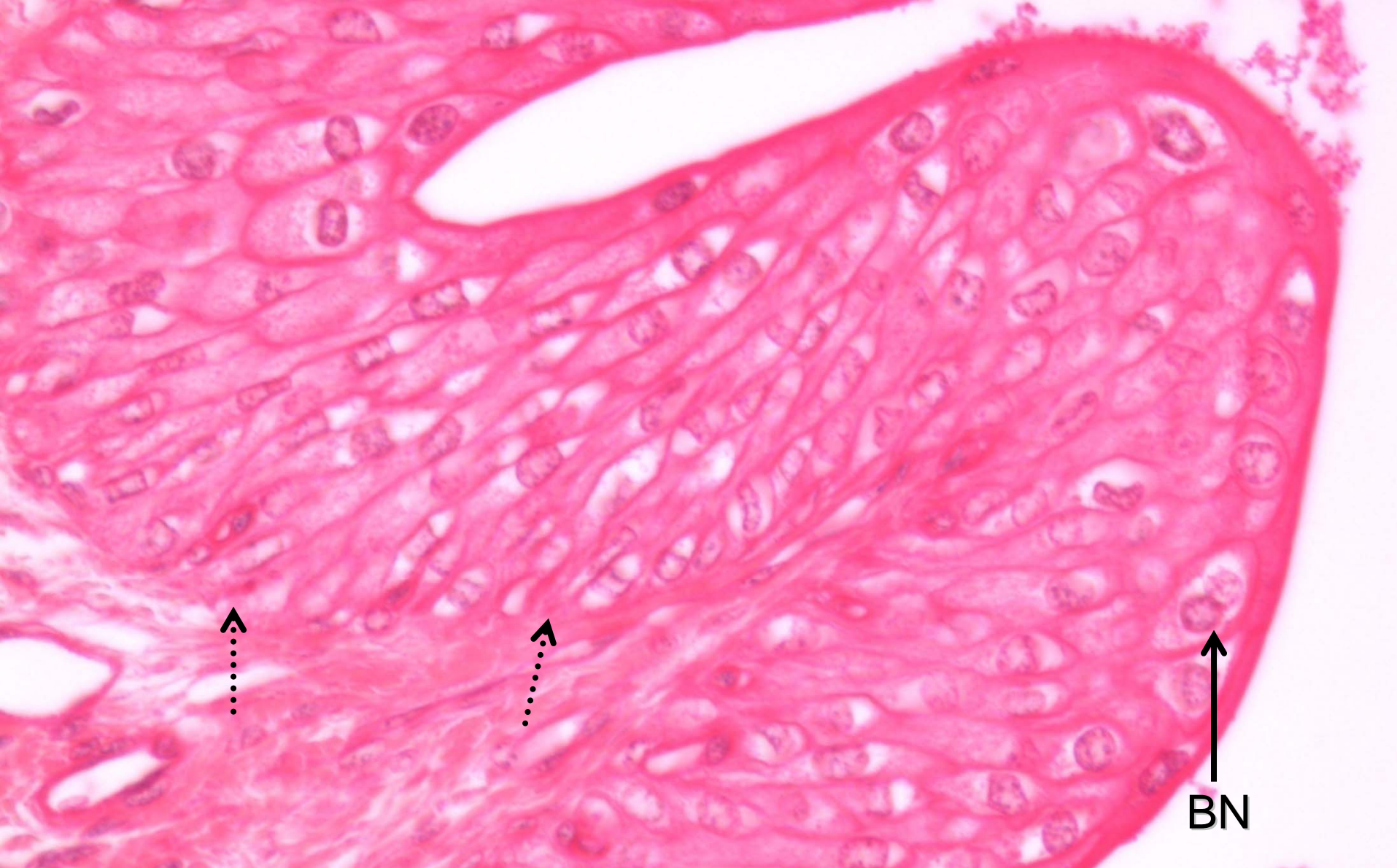


Fig 6. 93W3039  
Transitional epithelium.

BN: Binucleate cell

**Fig 6. Transitional epithelium, H&E.** Transitional epithelium is a form of stratified epithelium almost exclusively confined to the urinary tract. This epithelium type is so named because it has some features which are intermediate (transitional) between stratified cuboidal epithelium and stratified squamous epithelium. The basal cells are roughly cuboidal; the intermediate cells are polygonal. The surface cells are larger and rounded. The cells of the surface layer usually retain several characteristic features: Firstly, the surface cells are large and pale stained and present a scalloped surface outline. Secondly, the luminal surface of the cells appears thickened and more densely stained. Thirdly, the nuclei of the surface cells are large and round, and often exhibit prominent nucleoli; some surface cells are binucleate.

10x40

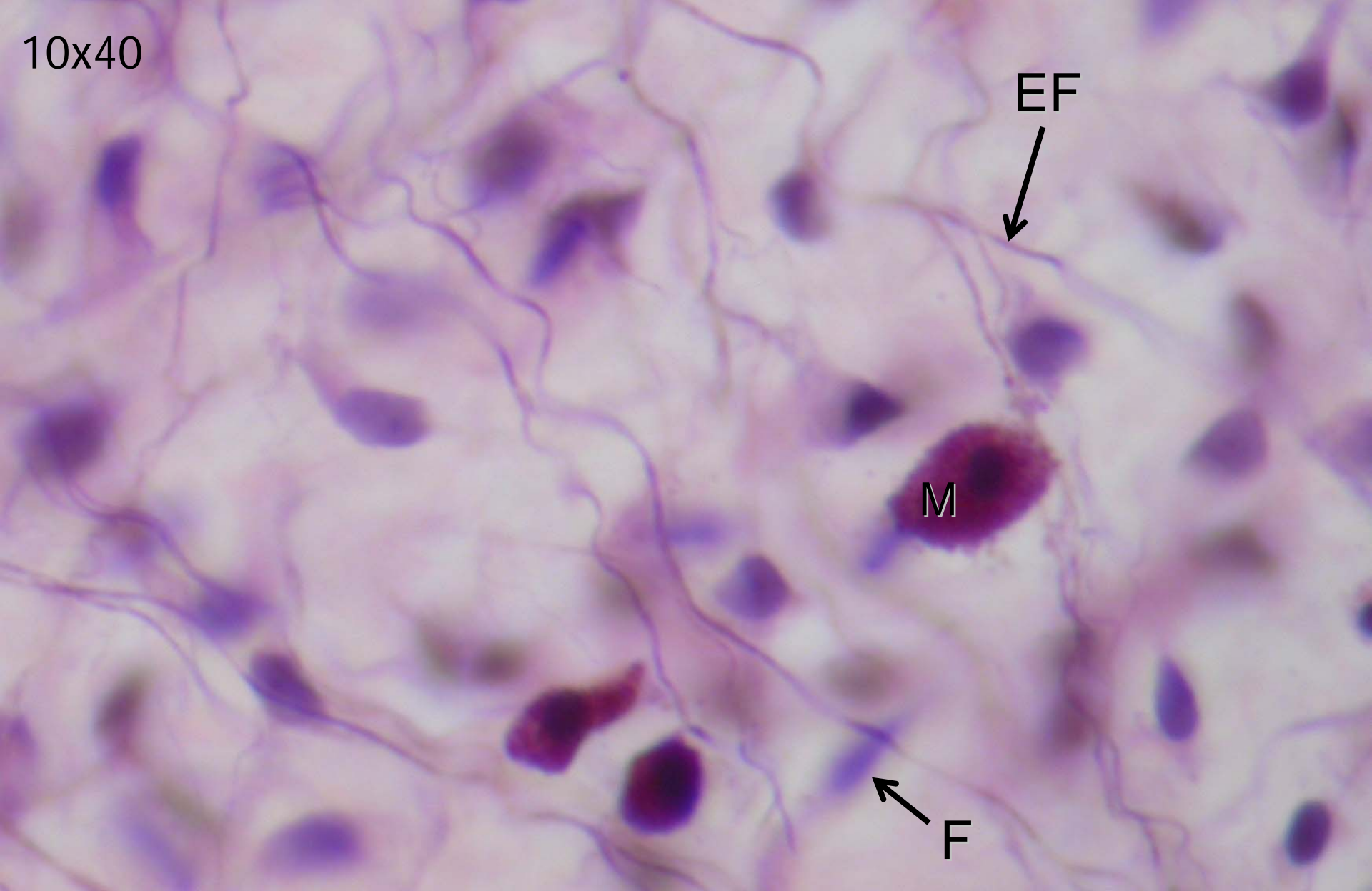


Fig 7. W3240, Mesentery,  
FeCl<sub>3</sub>-hematoxylin.

M: Mast cell  
F: Fibroblast

EF: Elastic fiber

**Fig 7. W3240, Mesentery, FeCl<sub>3</sub>-hematoxylin.** Loose connective tissue is characterized by loosely arranged fibers and abundant cells as compared to the dense connective tissue. The ground substance occupies more volume than the fibers do. This slide depicts a whole mount (wm) of mesentery through its entire thickness. The semifluid ground substance through which tissue fluid percolates is invisible, since it was extracted during the preparation of the slide. However, two types of fibers: the thicker, wavy, ribbon-like **collagen fibers** and the thin, straight, branching **elastic fibers** (EF) are well demonstrated. The **mast cells** (M) are easily to be identified, since they are the largest cells in the field and possess a granular cytoplasm. Nuclei of other cell types, i.e., lymphocytes, plasma cells, and macrophages, are also present but are not identifiable.

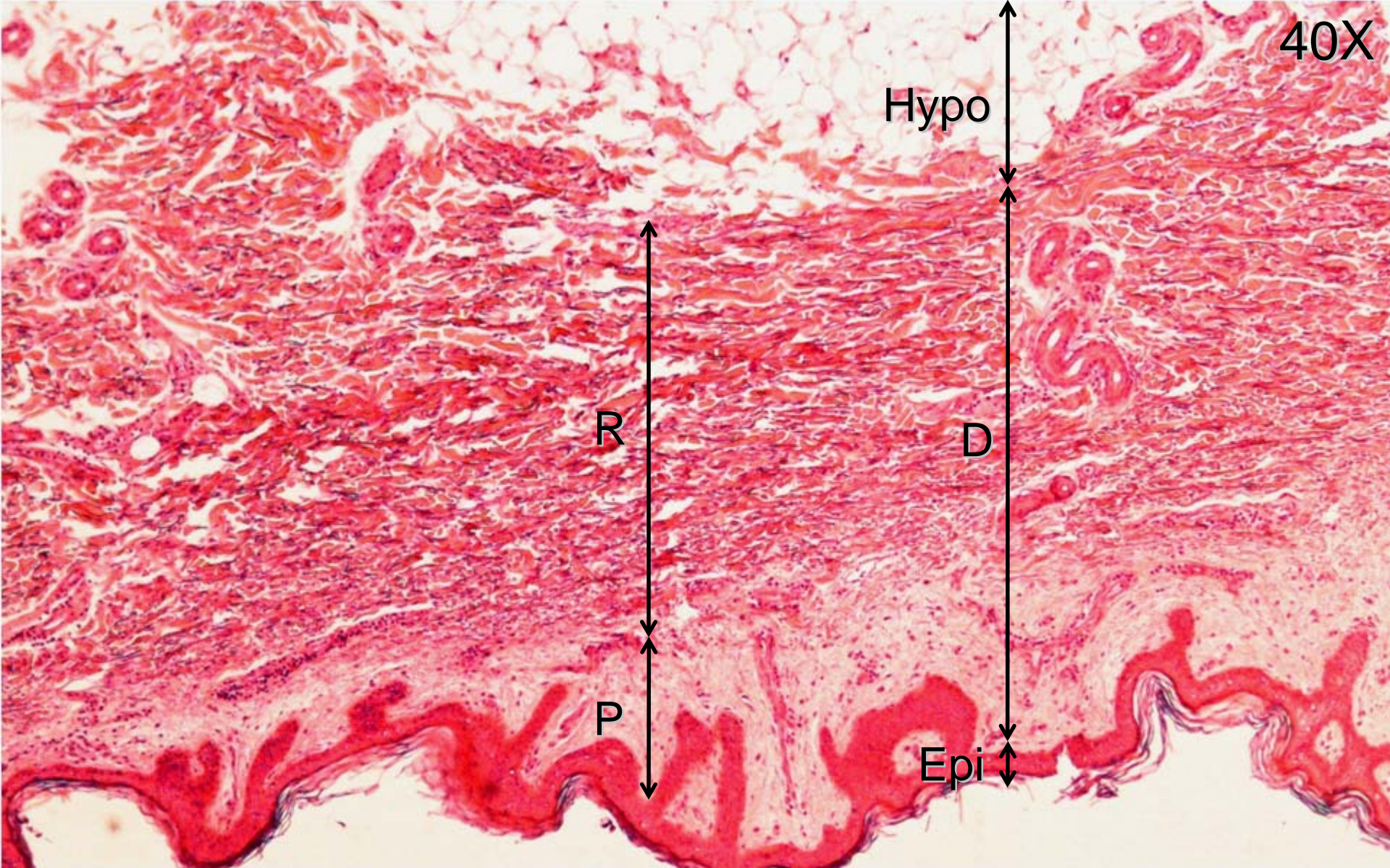


Fig 8. 93W7034  
Axillary Skin, HE.

Epi: Epidermis  
D: Dermis  
Hypo: Hypodermis

P: Papillary layer  
R: Reticular layer

**Fig 8. The skin.** The skin has three main layers: epidermis, dermis and hypodermis, respectively. **Epidermis** is an outer keratinized stratified squamous epithelium. **Dermis** is an underlying tough supporting and nourishing layer of fibroelastic tissue. **Hypodermis** is a variable deep layer, mainly composed of adipose tissue. It is easy to distinguish, even at this relatively low magnification, the three layers of the skin. The basic structures of three layers of the skin are explained in following slides. Dermis of the skin is composed of two layers: the papillary layer (P), loose connective tissue and the reticular layer (R), a dense irregular connective tissue.

400X



SSE

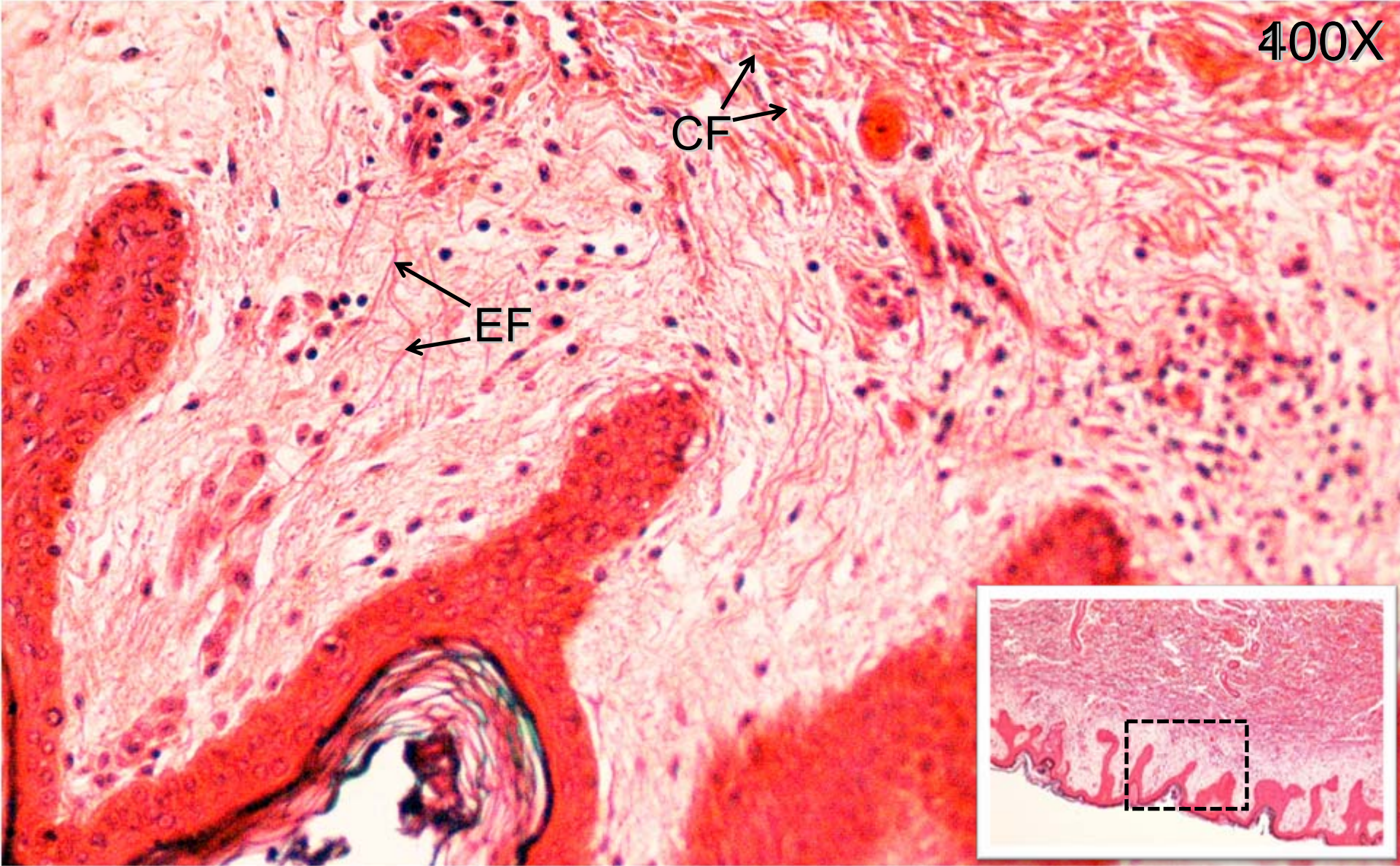
SC

Fig 9. 93W7034  
Axillary Skin, HE.

SSE: Stratified squamous epithelium (Kerattinzed)  
SC: Stratum corneum



**Fig 9. Epidermis of the thick skin.** The epidermis of the skin is composed of **stratified squamous epithelium (SSE)** that is keratinized. Especially on the palms of the hands and soles of the feet, the epidermis has an outer keratinized layer, **stratum corneum (SC)**, that is substantially thicker than that over the other parts of the body, referred to as thick skin. The cells of the basal layer are usually cuboidal or columnar. As the cells produced by mitosis are moved outward into progressively more superficial layers they become more differentiated and tend to become squamous (used in classifying the epithelium). The stratum corneum (SC) is composed of dead cells that have no nuclei.



400X

CF

EF

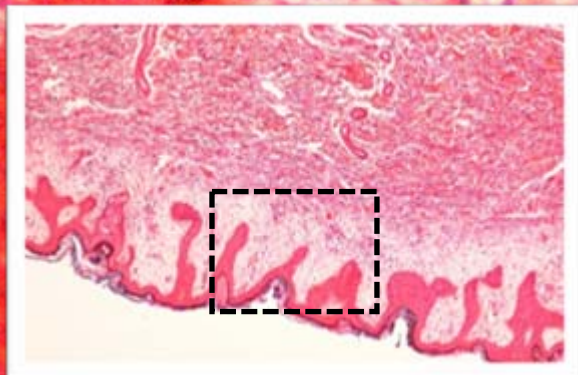


Fig 10. 93W7034  
Axillary Skin, HE.

CF: collagen fiber  
EF: elastic fiber

**Fig 10. Dermis of thick skin.** This photomicrograph shows the connective tissue of the skin, referred to as dermis, stained to show the nature and distribution of the **elastic fibers (EF)**, which appear purple. The **collagen fibers (CF)** have been stained by eosin, and the two fiber types are easily differentiated. The elastic fibers of the dermis have a 3D interlacing configuration, thus the variety of forms.

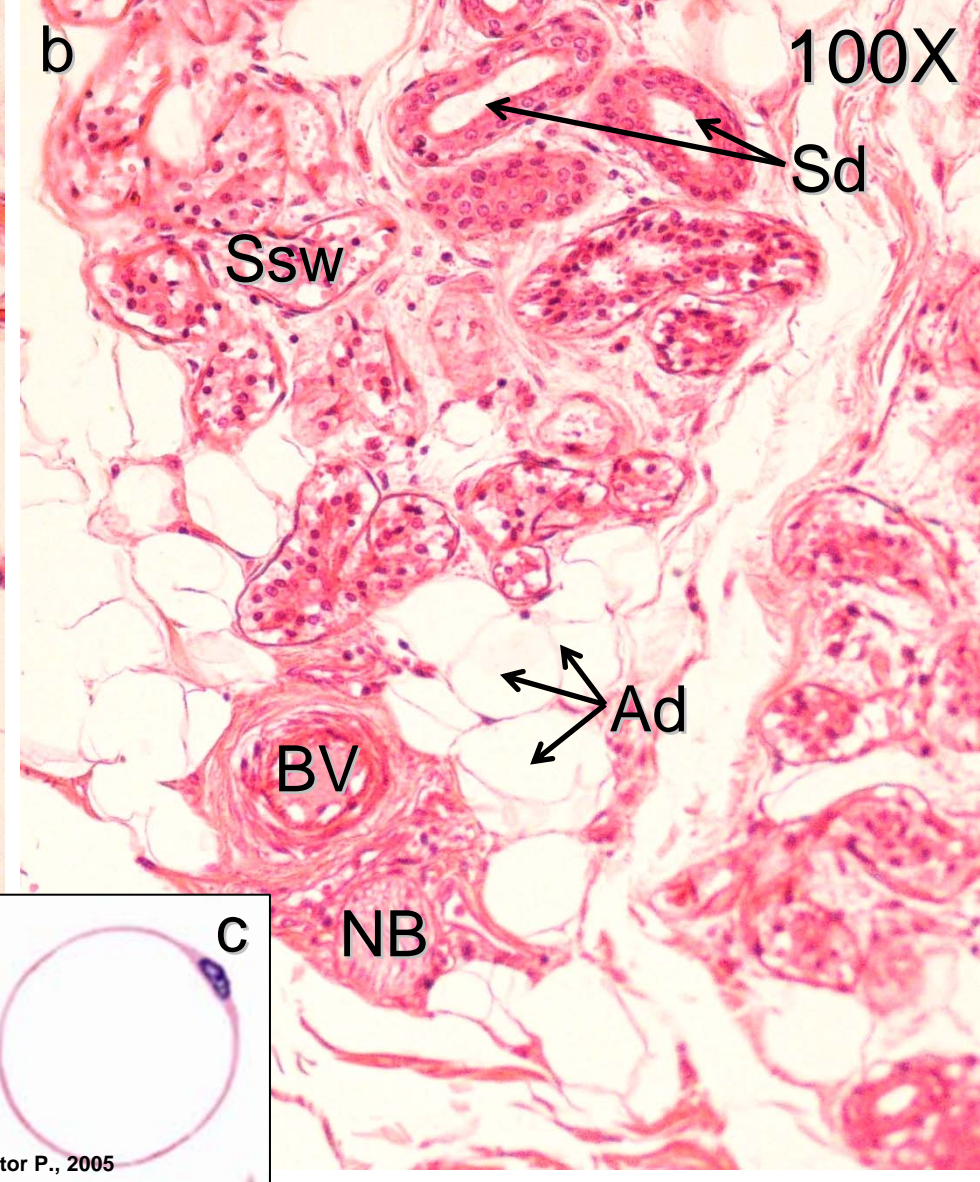
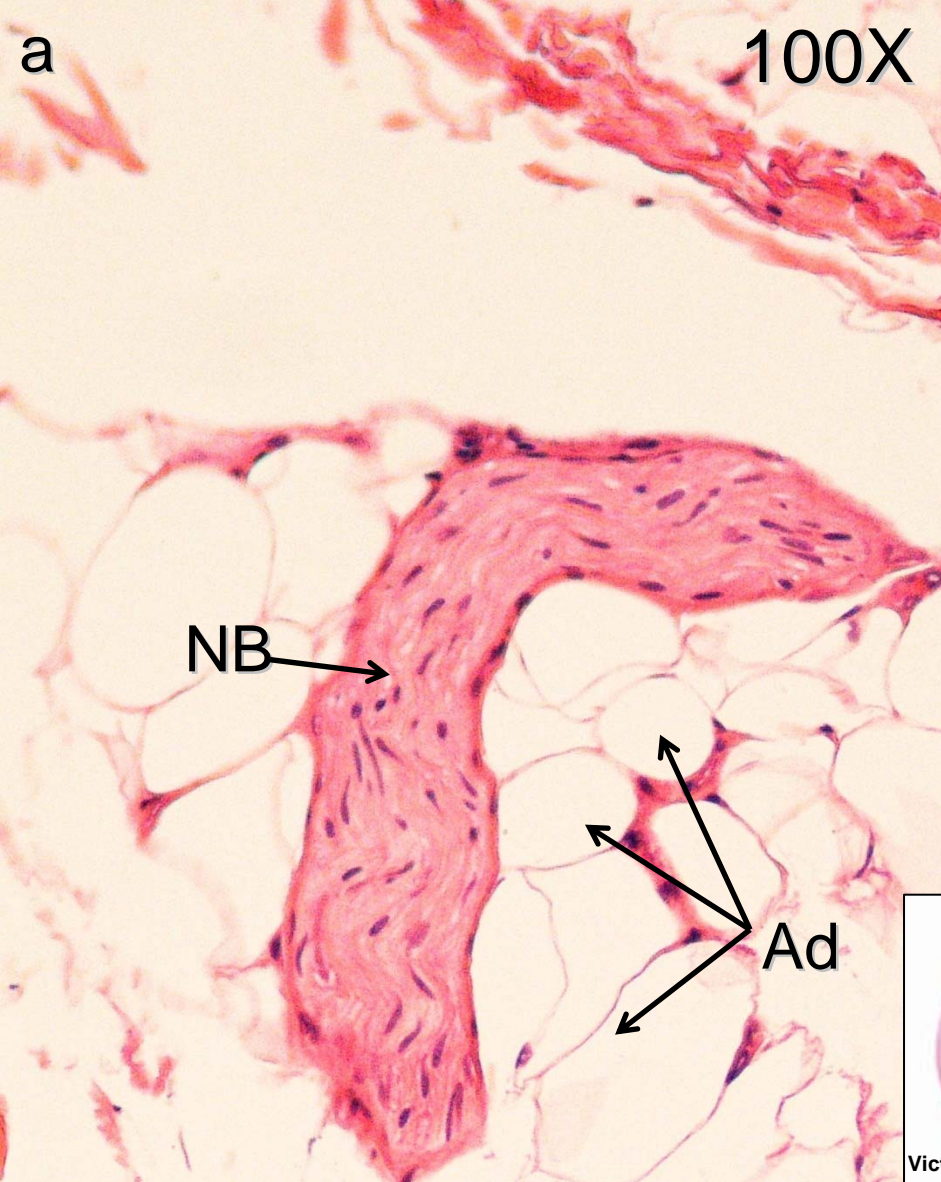


Fig 11. 93W7034  
Axillary Skin, HE.

Ad: Adipocyte

Ssw: Secretory portion of sweat gland

Sd: Sweat duct

BV: Blood vessel

NB: Nerve fiber bundle

**Fig 11. Hypodermis of the thick skin.** The lower magnification photomicrograph shows part of the hypodermis of the thick skin. It contains abundant adipocytes. The adipocyte (Ad) nucleus is compressed and displaced to one side of the stored lipid droplets and the cytoplasm including organelles is reduced to a small rim (Fig 11c). Fig 11a shows several **adipocytes** and **nerve fiber bundles** (NB). Fig 11b shows profiles of an **eccrine sweat gland** (Sw) and several **blood vessels** (BV). The cross sections of a blood vessel and a sweat gland can also be seen. However, the wall of blood vessels is composed of the squamous epithelium and the smooth muscle layer. The sweat gland has two parts: the secretory portion (Ssw) and the excretory duct (sweat duct, Sd). The secretory cells are arranged in circles (pseudostratified epithelium) having small lumen and the wall of the sweat duct is composed of stratified cuboidal cells.

# Summary

93W7120,  
Kidney, H&E

Simple squamous epithelium  
Simple cuboidal epithelium

93W4875,  
Trachea and  
esophagus,  
H&E

Stratified squamous epithelium  
Smooth muscle, Skeletal muscle  
Pseudostratified ciliated columnar epithelium  
Cilia  
Dense regular connective tissue  
Adipose tissue  
Nerve fiber bundle, Blood vessel (Artery)

93W3039,  
Transitional epithelium,  
H&E

Transitional epithelium  
Adipose tissue, Blood vessel  
Smooth muscle

93W3240,  
Mesentery,  
FeCl<sub>3</sub>-hematoxylin

Elastic fiber  
Fibroblast, Mast cell

93W7034,  
Thick skin,  
HE

Stratified squamous epithelium  
(Keratinized)  
Dense connective tissue  
Loose connective tissue  
Collagen fiber, Fibroblast nuclei  
Sweat gland (secretory or  
excretory portion), Adipocyte  
Blood vessel, Nerve fiber bundle