

組織學實驗：呼吸系統

Histology laboratory : Respiratory system

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Please study these slides before coming to the class!

Sources of the Pictures & Text

- **Histology: A Text and Atlas (2005)**
Michael H. Ross
- **Human Anatomy (2004)**
Elaine N. Marieb

Photomicrograph Taken by

**Department of anatomy,
Kaohsiung Medical University**

Microscopic structure of respiratory system by observing following slides

1. Nasal septum

93W4847, Nasal Epithelium, Mammal, HE

2. Larynx and Vocal fold

93W4855, Larynx, HE

3. Trachea and Esophagus

NO-5-a, Trachea, human, HE, (單組)

93W4875, Trachea & Esophagus, HE

4. Bronchus

93W6912, Trachea (Bronchus), HE

5. Lung

NO-6-b, lung, Mallory stain, (單組)

O-6-h or k , lung, HE, (單組)

Learning Objective

- Understand the structures of the conducting portion of the respiratory system.
- Recognize and describe respiratory epithelium and its structural features.
- Understand the structures of the larynx, trachea, and bronchial trees.
- Understand the structure of respiratory bronchioles, alveolar ducts, and alveoli.

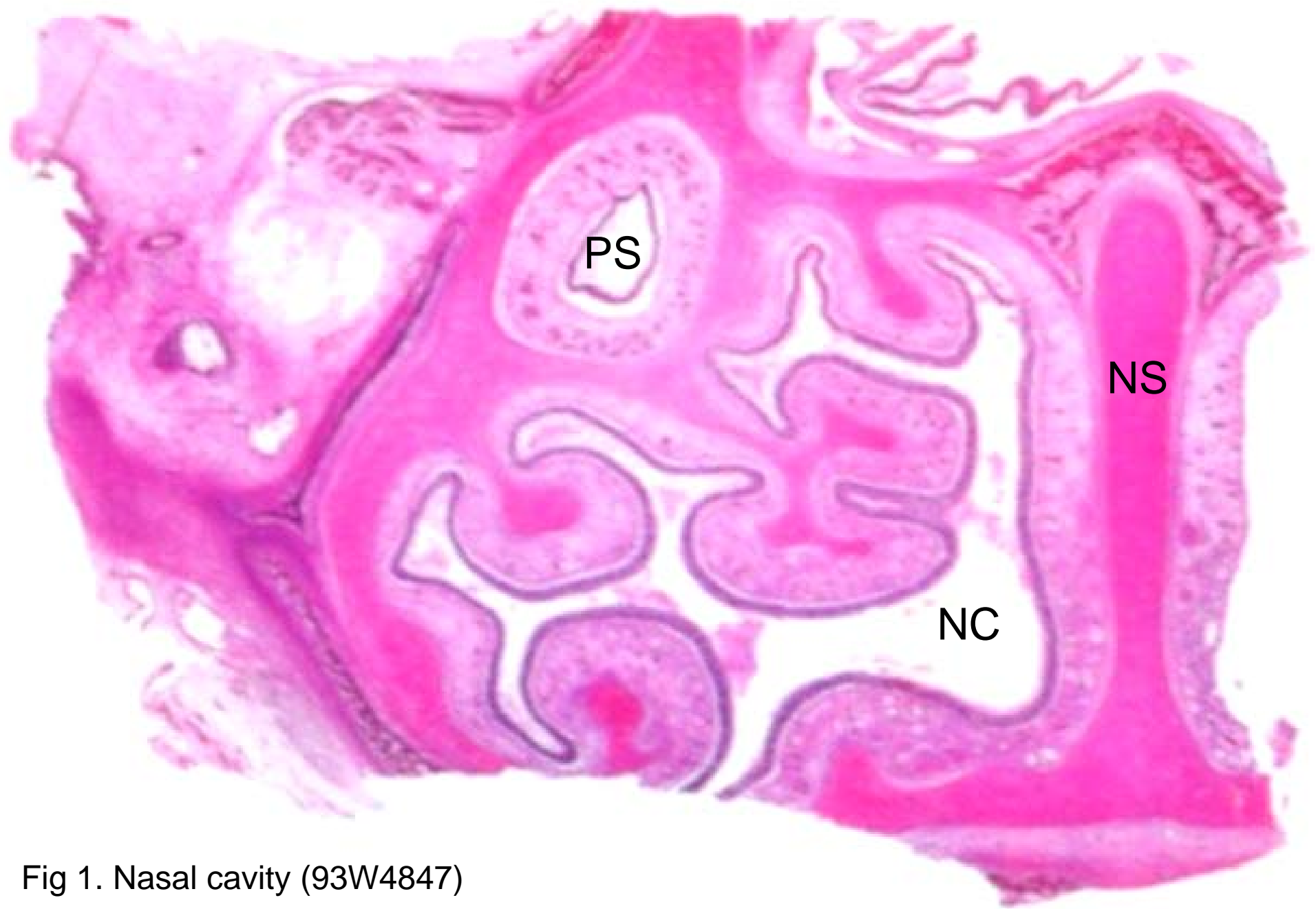


Fig 1. Nasal cavity (93W4847)

NC: nasal cavity ; **NS:** nasal septum ; **PS:** paranasal sinuses

Fig 1. Nasal cavity (93W4847)

The nose is subdivided into two nasal cavities (NC) by the cartilaginous the nasal septum (NS). The nasal cavities and paranasal sinuses (PS) are lined by respiratory mucosa.



PCE: pseudostratified columnar ciliated epithelium

V: venules

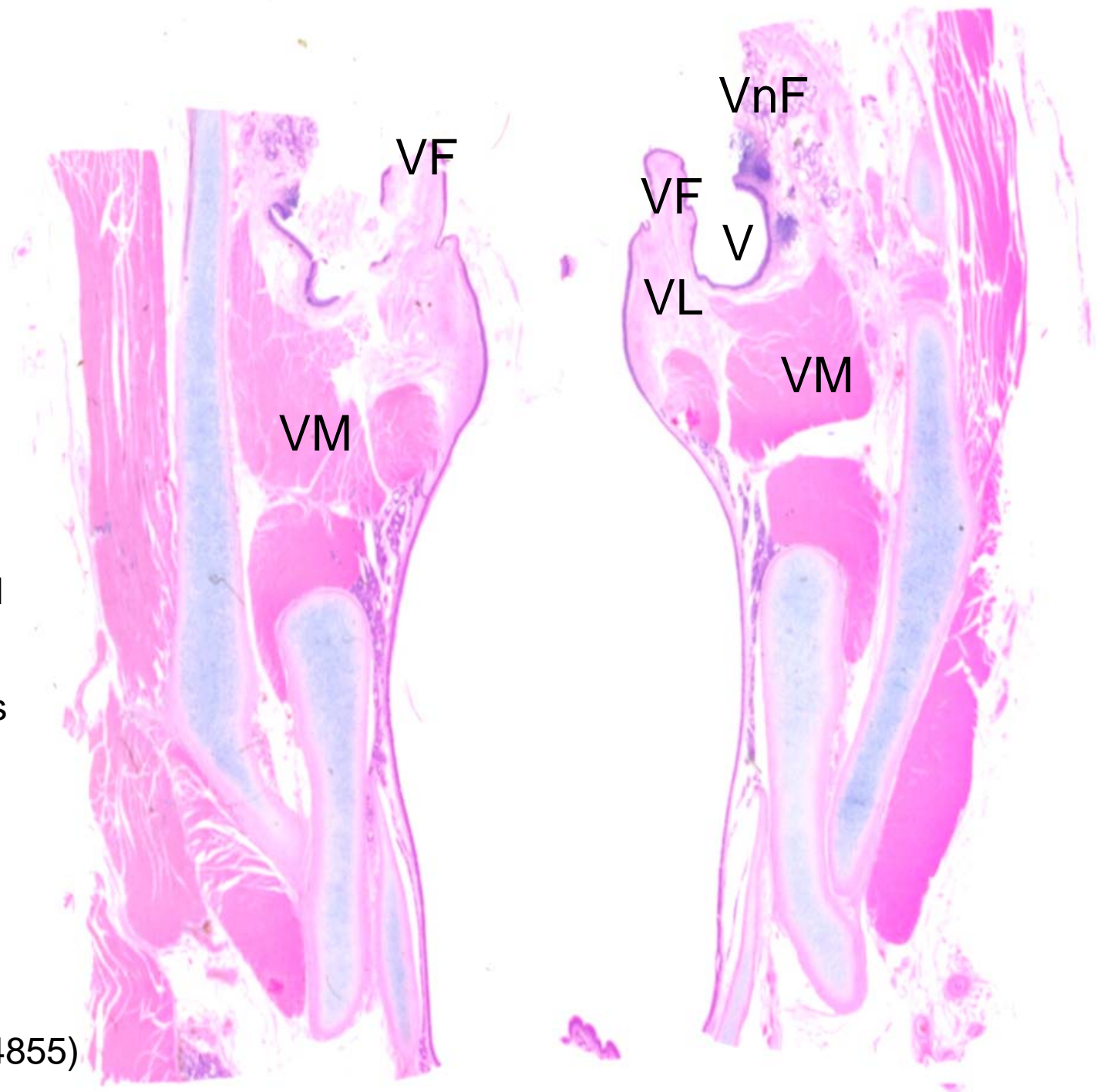
LP: lamina propria

G: glands

Fig 2. Nasal mucosa (93W4847)

Fig 2. Nasal mucosa (93W4847)

The respiratory mucosa consists of a pseudostratified columnar ciliated epithelium (PCE) supported by a richly vascular (V) lamina propria (LP) containing mixed glands (G).



VF: vocal folds

VnF: ventricular fold

V: ventricle

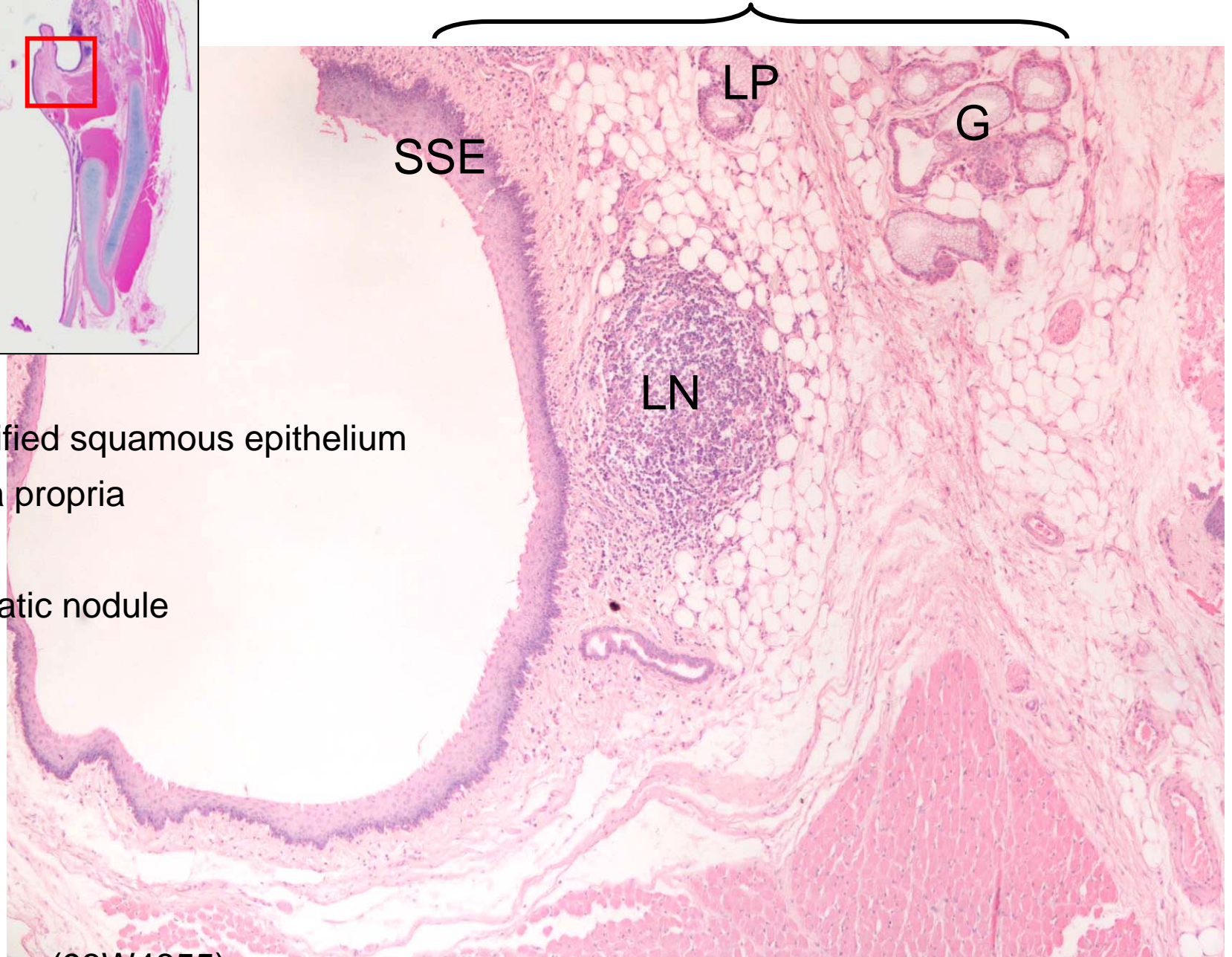
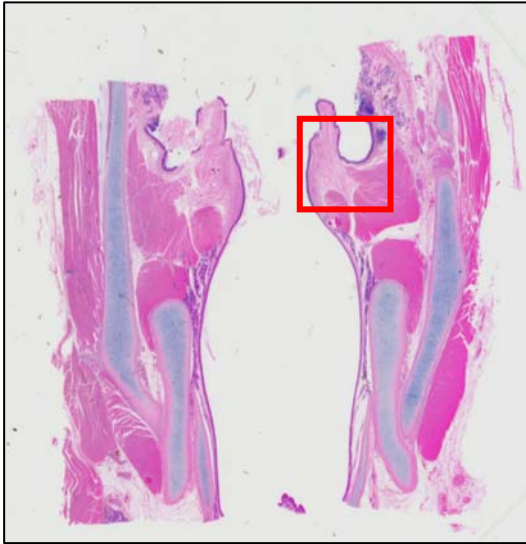
VM: vocalis muscles

VL: vocal ligament
within vocal fold

Fig 3. Larynx (93W4855)

Fig 3. Larynx (93W4855)

The two vocal folds (VF) and the space between them constitute the glottis. Just above each vocal fold is an elongated recess called the ventricle (V), and above the ventricle is another ridge called the ventricular fold (VnF) or, sometimes, the false vocal fold. Below and lateral to the vocal folds are the vocalis muscles (VM). The elastic material is a component of the vocal ligament (VL).



SSE: stratified squamous epithelium

LP: lamina propria

G: glands

LN: lymphatic nodule

Fig 4. Larynx (93W4855)

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The surfaces of the vocal fold are lined by stratified squamous epithelium (SSE). The lamina propria (LP) consists of loose connective tissue in which glands (G) and lymphatic nodule (LN) are present.

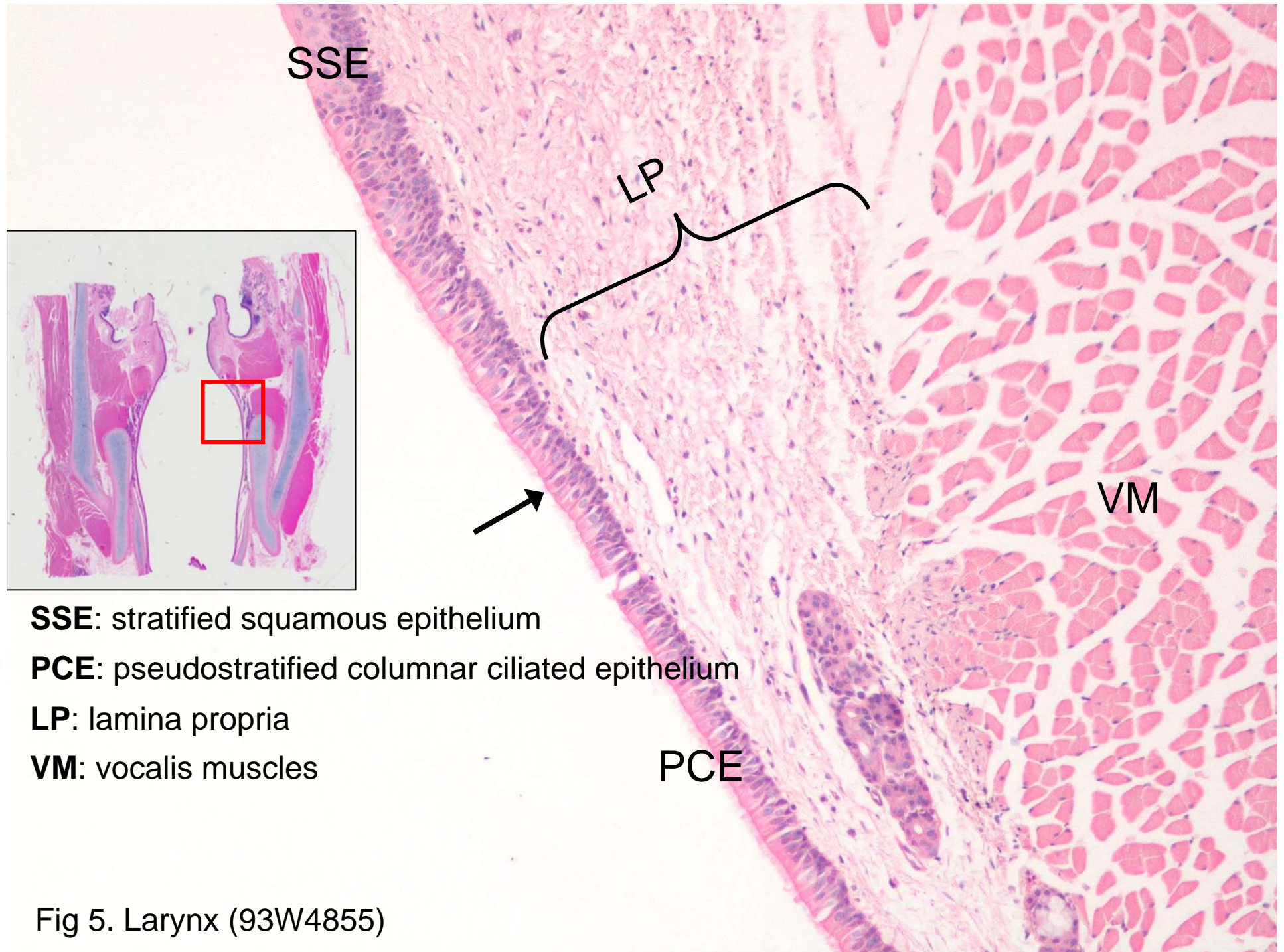


Fig 5. Larynx (93W4855)

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It shows the lateral surfaces and lower part of the vocal fold.

The arrow shows an interface between the stratified squamous epithelium (SSE), with its flat surface cells, and the pseudostratified columnar ciliated epithelium (PCE), with its columnar surface cells, is present. The lamina propria (LP) consists of loose connective tissue. Adjacent to the lamina propria the vocalis muscles (VM) can be observed.

C: C-shaped hyaline cartilage
T: trachea
E: esophagus

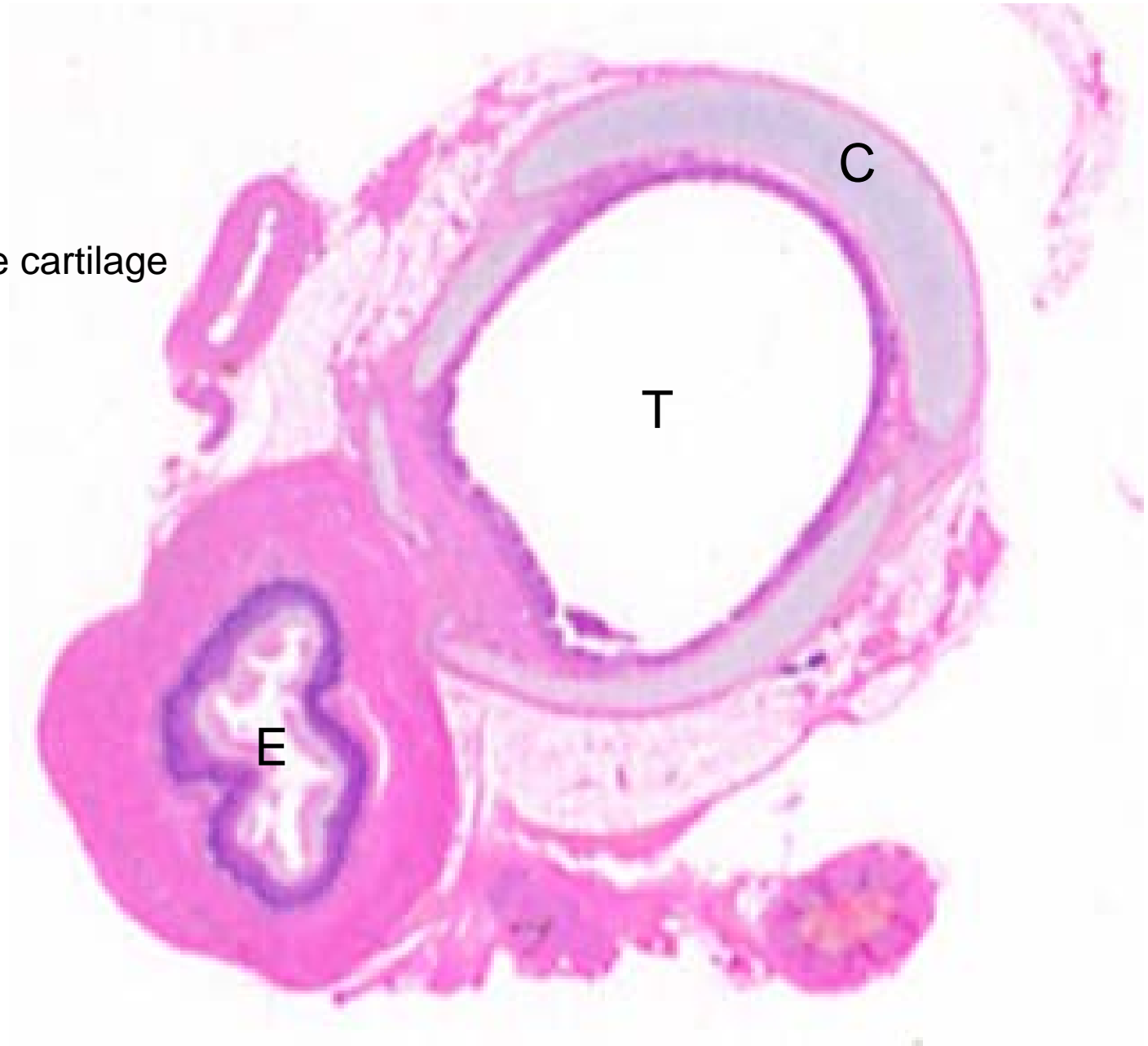


Fig 6. Trachea (93W4875)

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The lumen of the trachea is held open by a series of C-shaped hyaline cartilages that are stacked on one another to form a supporting structure.

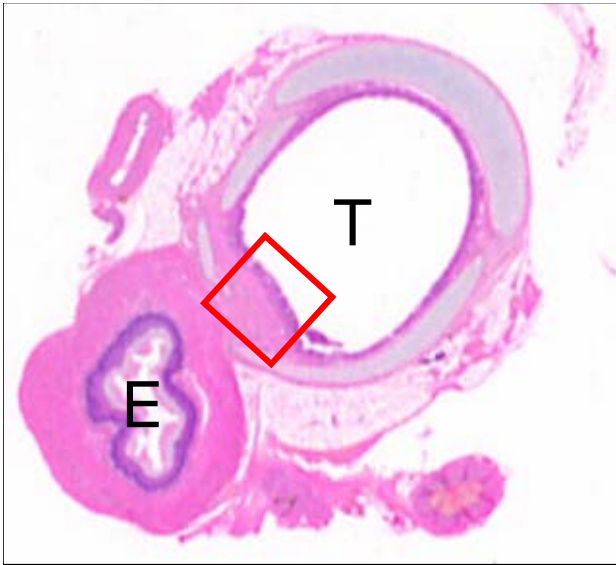


Fig 7. Trachea (93W4875)

C: hyaline cartilage ; **T:** trachea

E: esophagus ; **TM:** trachealis muscle

PCE: pseudostratified columnar ciliated epithelium

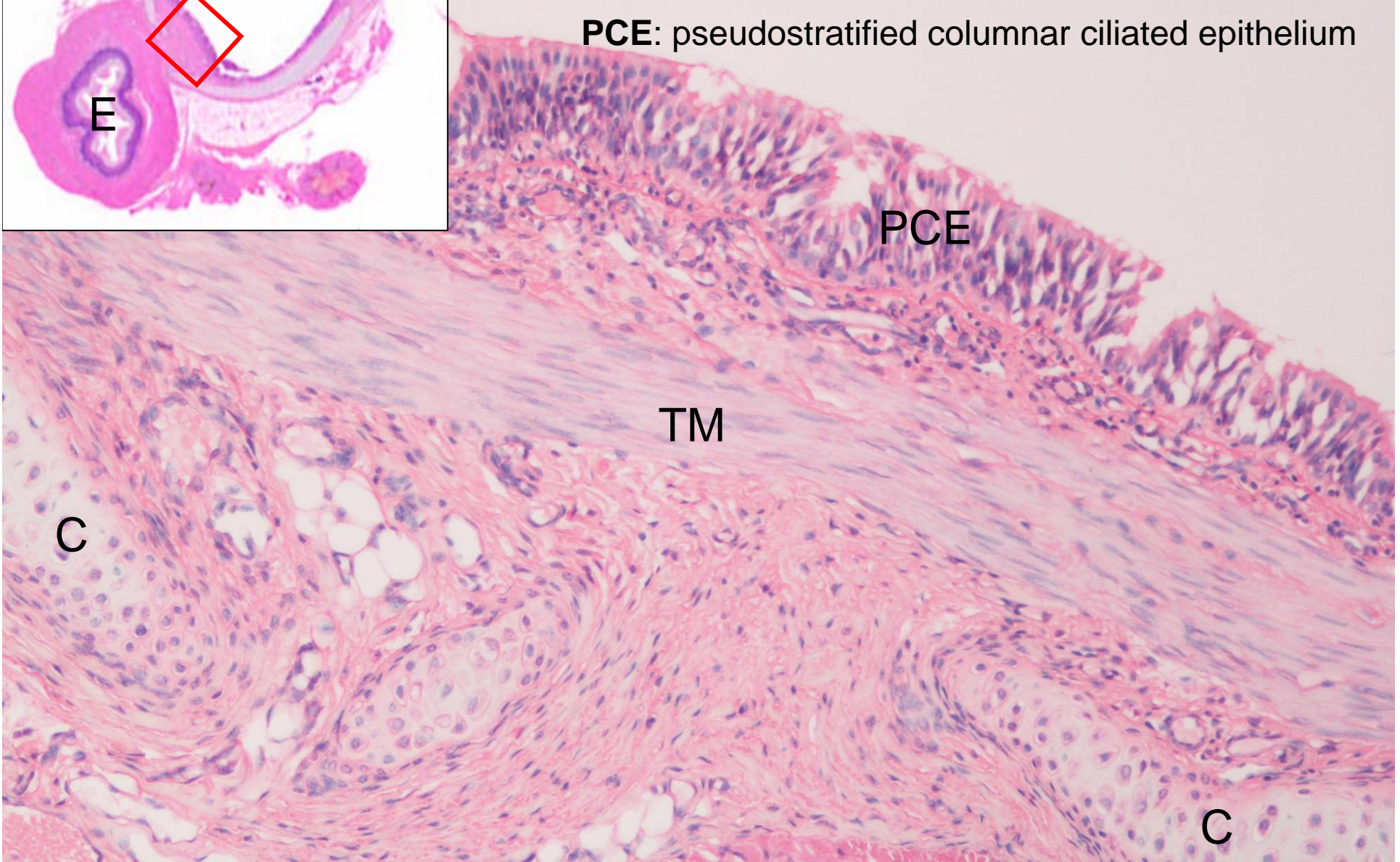


Fig 7. Trachea (93W4875)

The trachealis muscle (TM), a band of smooth muscle that fills the gap between the posterior ends of the C-shaped tracheal cartilages (C) is shown here (adjacent to the esophagus).

Typical respiratory (ciliated pseudostratified columnar) epithelium lines the trachea and primary bronchi.

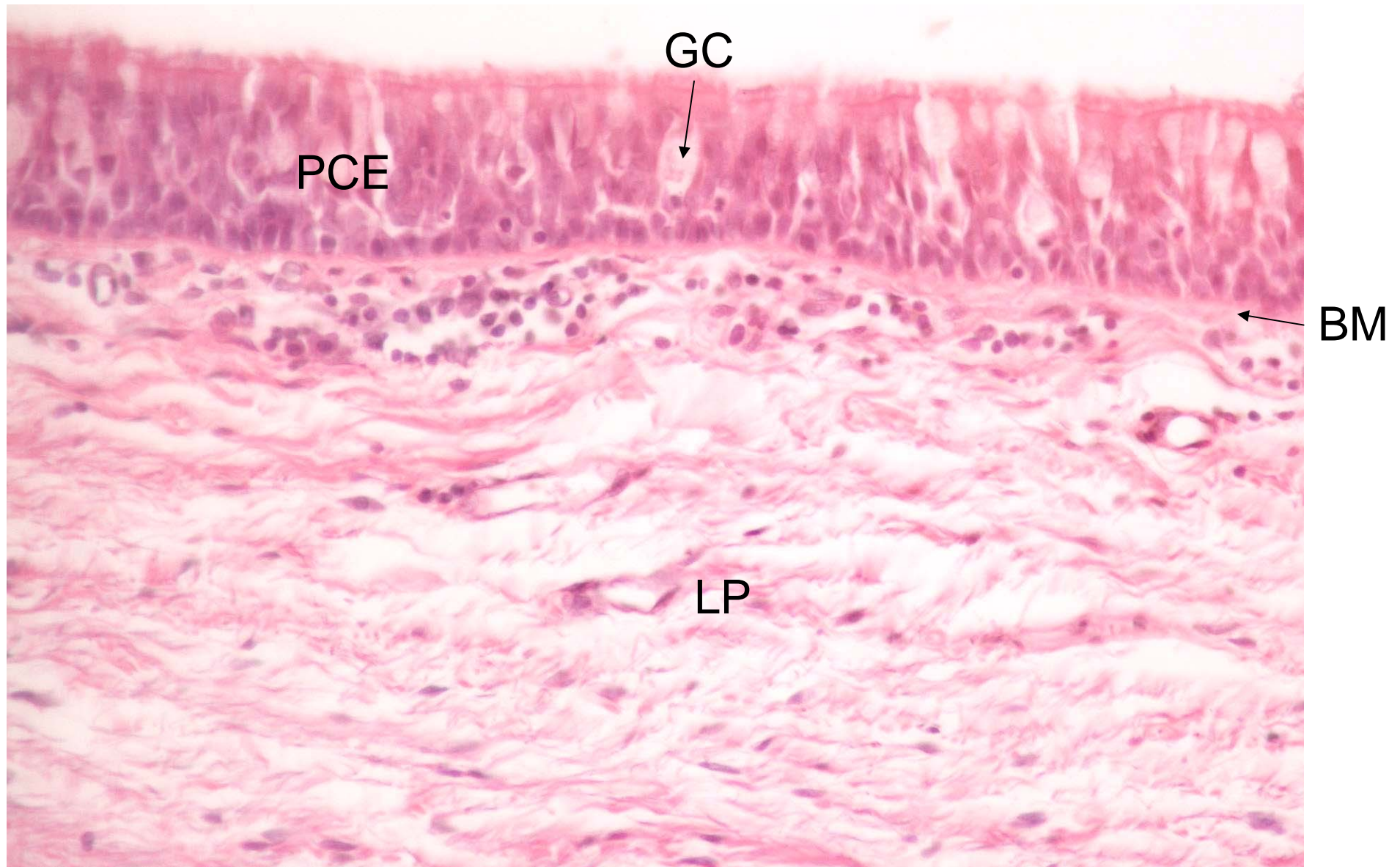
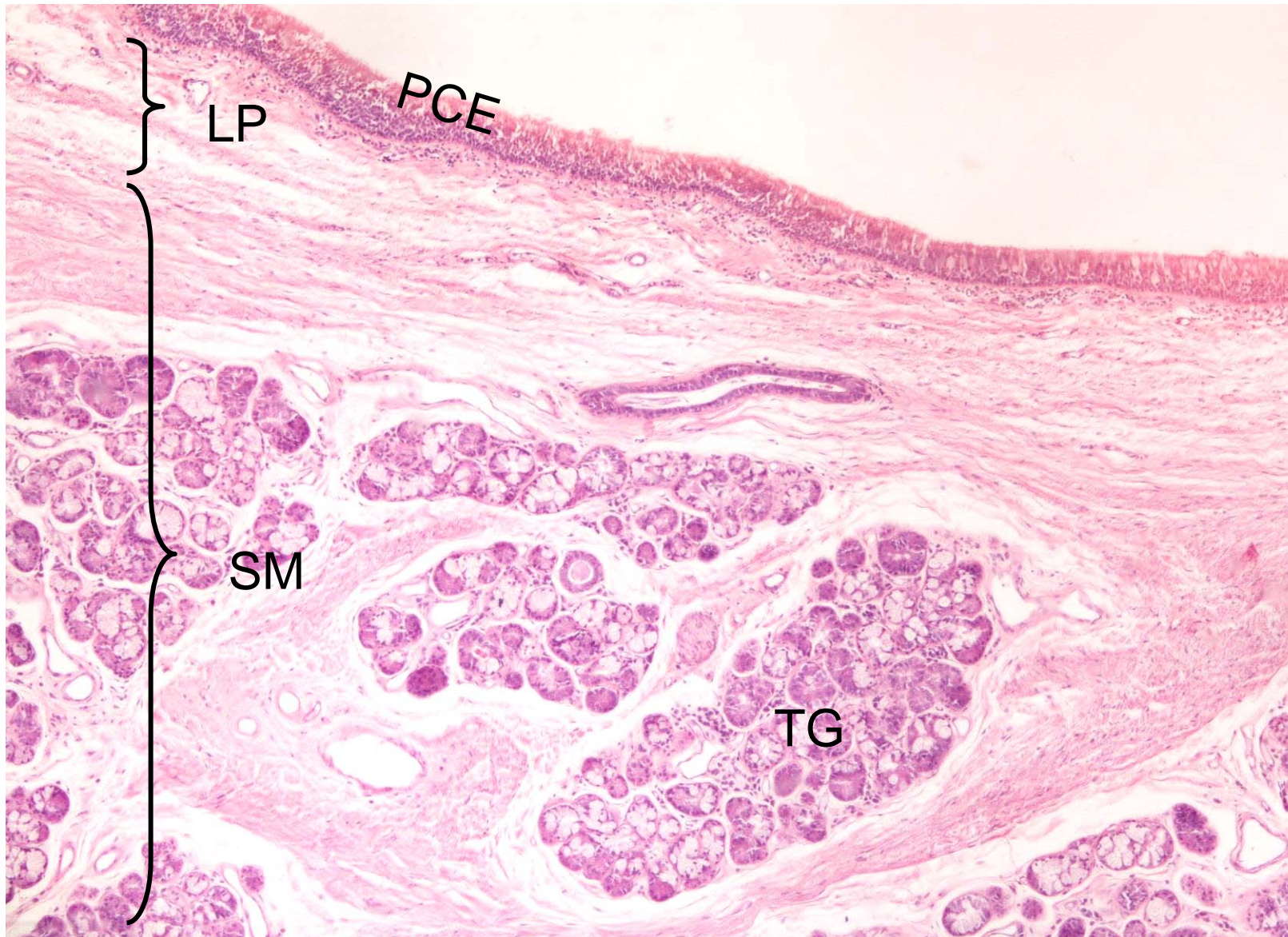


Fig 8. Trachea (NO-5-a)

PCE: pseudostratified columnar ciliated epithelium

BM: basement membrane ; **LP:** lamina propria

GC: goblet cells



PCE: pseudostratified columnar ciliated epithelium

LP: lamina propria ; **SM:** submucosa

TG: tracheal glands

Fig 9. Trachea (NO-5-a)

Fig 8 & 9. Trachea (NO-5-a)

The wall of the trachea shows the pseudostratified columnar ciliated epithelium (PCE) located on a well-developed basement membrane (BM). A thin lamina propria (LP) and a dense thick submucosa (SM) underlie the respiratory epithelium. Numerous goblet cells (GC) are evident as clear ovoid spaces in the respiratory epithelium. Seromucous glands (tracheal glands) (TG) are seen in the submucosa.

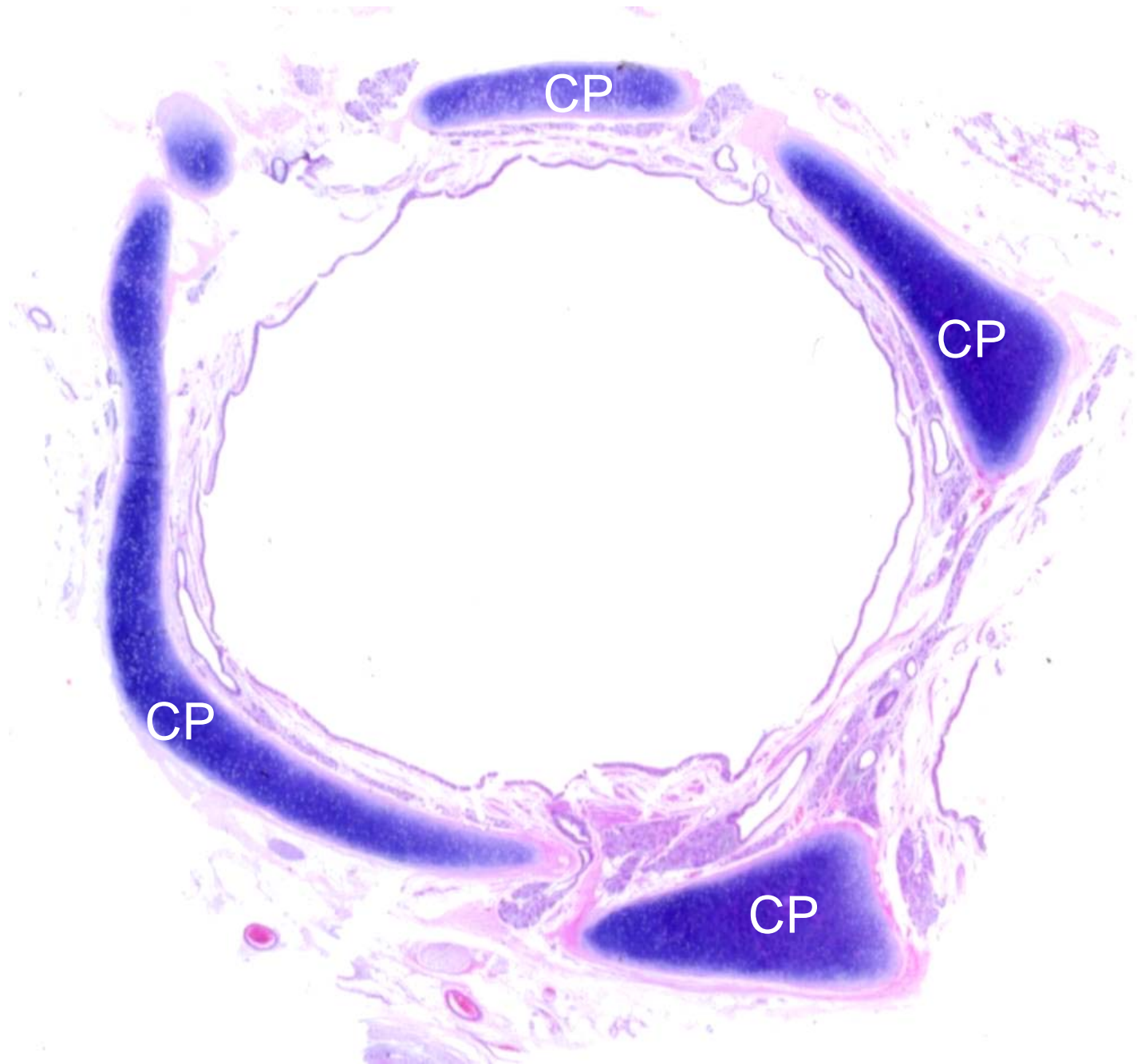


Fig 10. Bronchus (93W6912)

CP: cartilaginous plates

Fig 10. Bronchus (93W6912)

Within the bronchus, the cartilaginous plates (CP) are arranged into flattened, interconnected plates (sometimes overlapping) rather than discrete C-shaped cartilages as in the trachea.

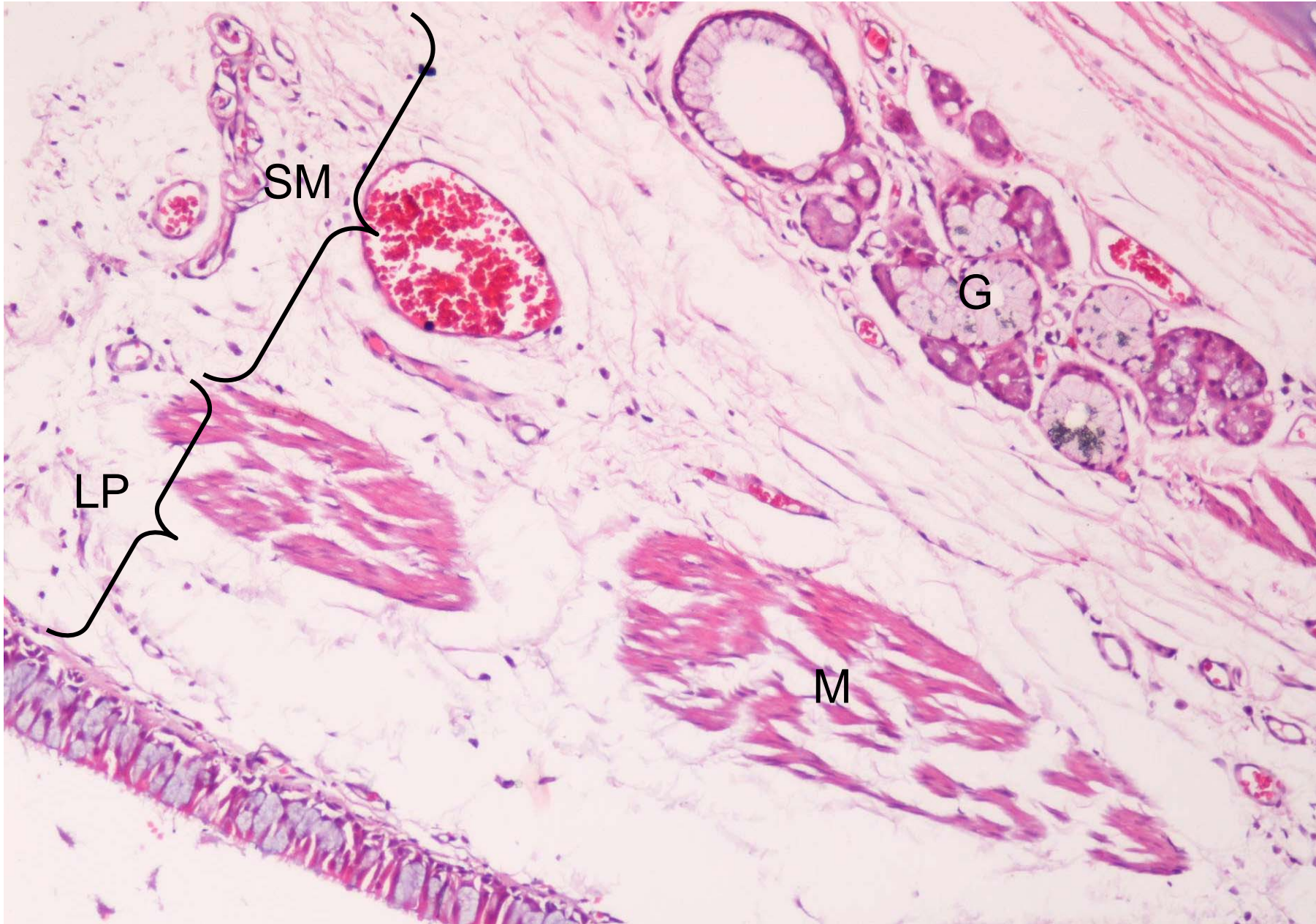
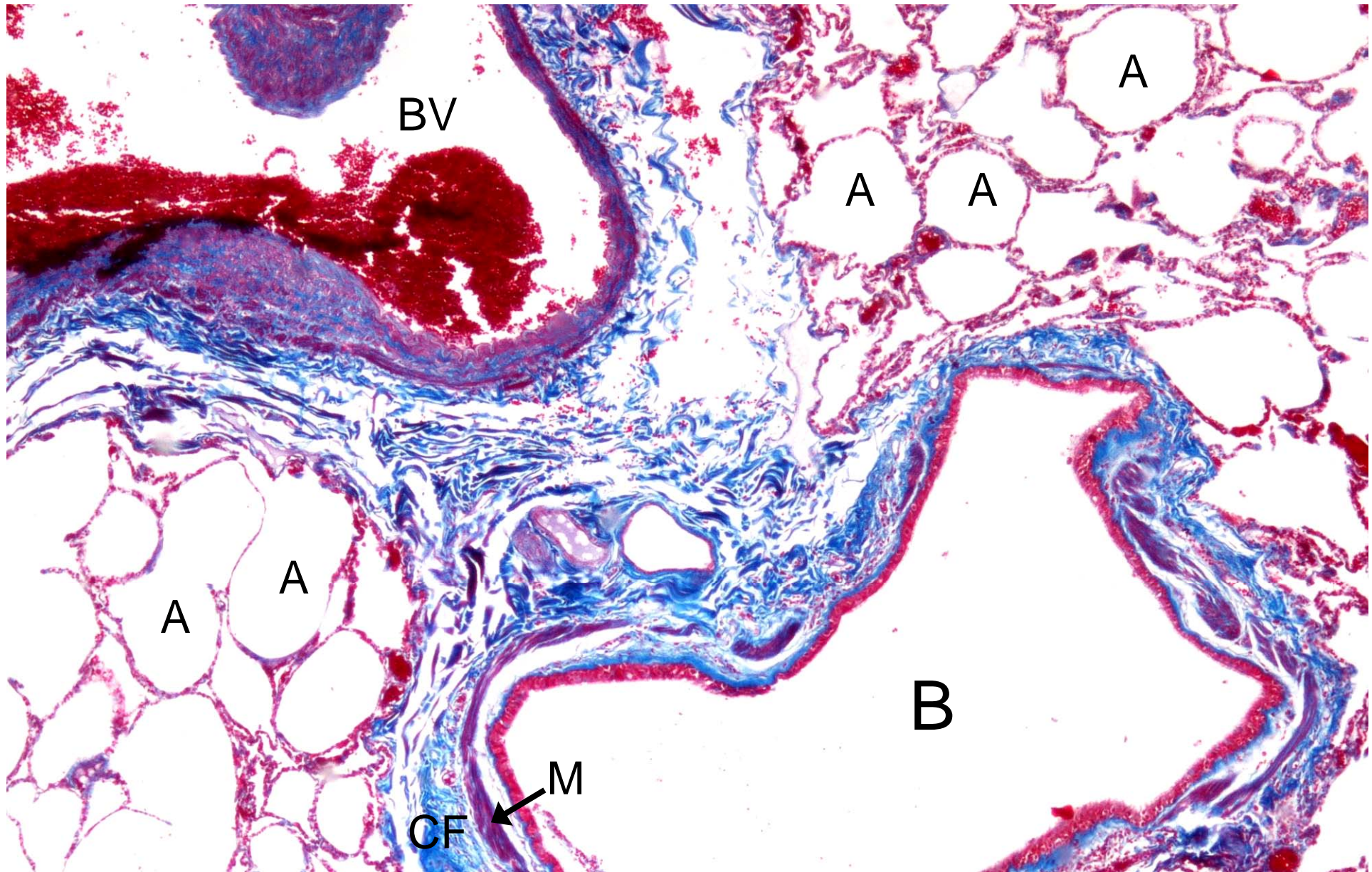


Fig 11. Bronchus (93W6912)

LP: lamina propria ; **SM:** submucosa
M: smooth muscle ; **G:** mixed glands

Fig 11. Bronchus (93W6912)

The basic structure of the bronchi (B) is similar to that of the trachea, but differs in details, as follows: The lamina propria (LP) is separated from the submucosa (SM) by a discontinuous layer of smooth muscle (M) which becomes progressively more prominent in smaller airways. The submucosa layer contains fewer mixed glands (G).



B: bronchiole ; **BV:** blood vessels ; **A:** alveolus

CF: collagenous fibers (blue) ; **M:** smooth muscle (red)

Fig 12. Lung (NO-6-b)

Fig 12. Lung (NO-6-b)

A typical bronchiole is shown here. Blood vessels (BV) are adjacent to the bronchiole. The main features of the bronchiolar wall evident in the figure are bundles of smooth muscle (M) and the lining epithelium. The connective tissue is minimal and, at this low magnification, not conspicuous. Nevertheless, the connective tissue is present and separates the muscle into bundles. The connective tissue contains collagenous fibers (CF). Glands are not present in the wall of the bronchiole. Surrounding the bronchiole, are the air spaces or alveoli (A) of the lung.

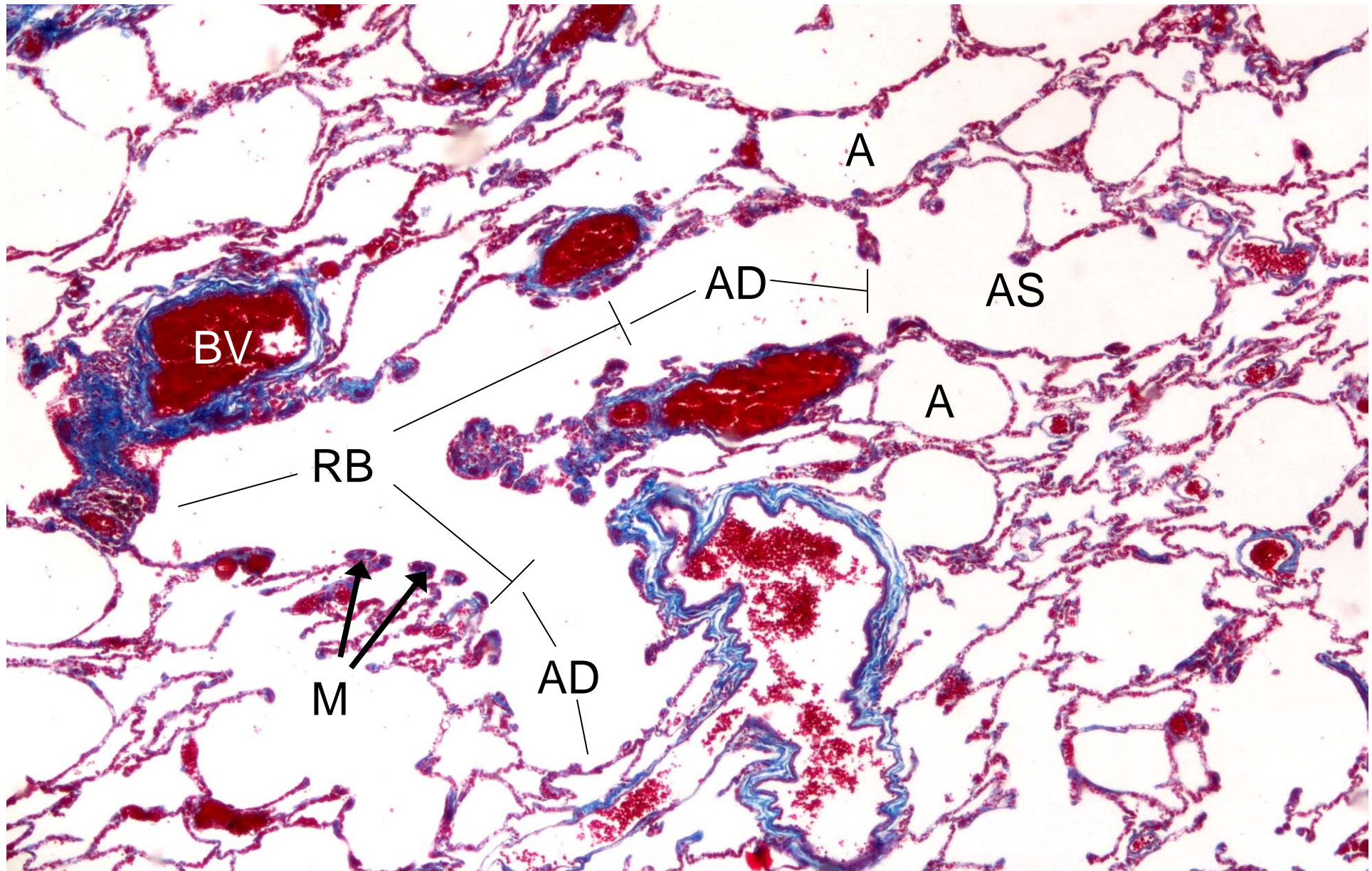


Fig 13. Lung (NO-6-b) **RB**: respiratory bronchiole ; **A**: alveolus ; **BV**: blood vessels
M: smooth muscle ; **AD**: alveolar ducts ; **AS**: alveolar sac

Fig 13. Lung (NO-6-b)

The respiratory bronchiole (RB) has a wall composed of two portions of different thickness. The most distal component of the respiratory passage is the alveolus. Groups of alveoli are clustered together sharing a common opening and are referred to as the alveolar sac (AS). Alveoli that form a tube are referred to as alveolar ducts (AD).

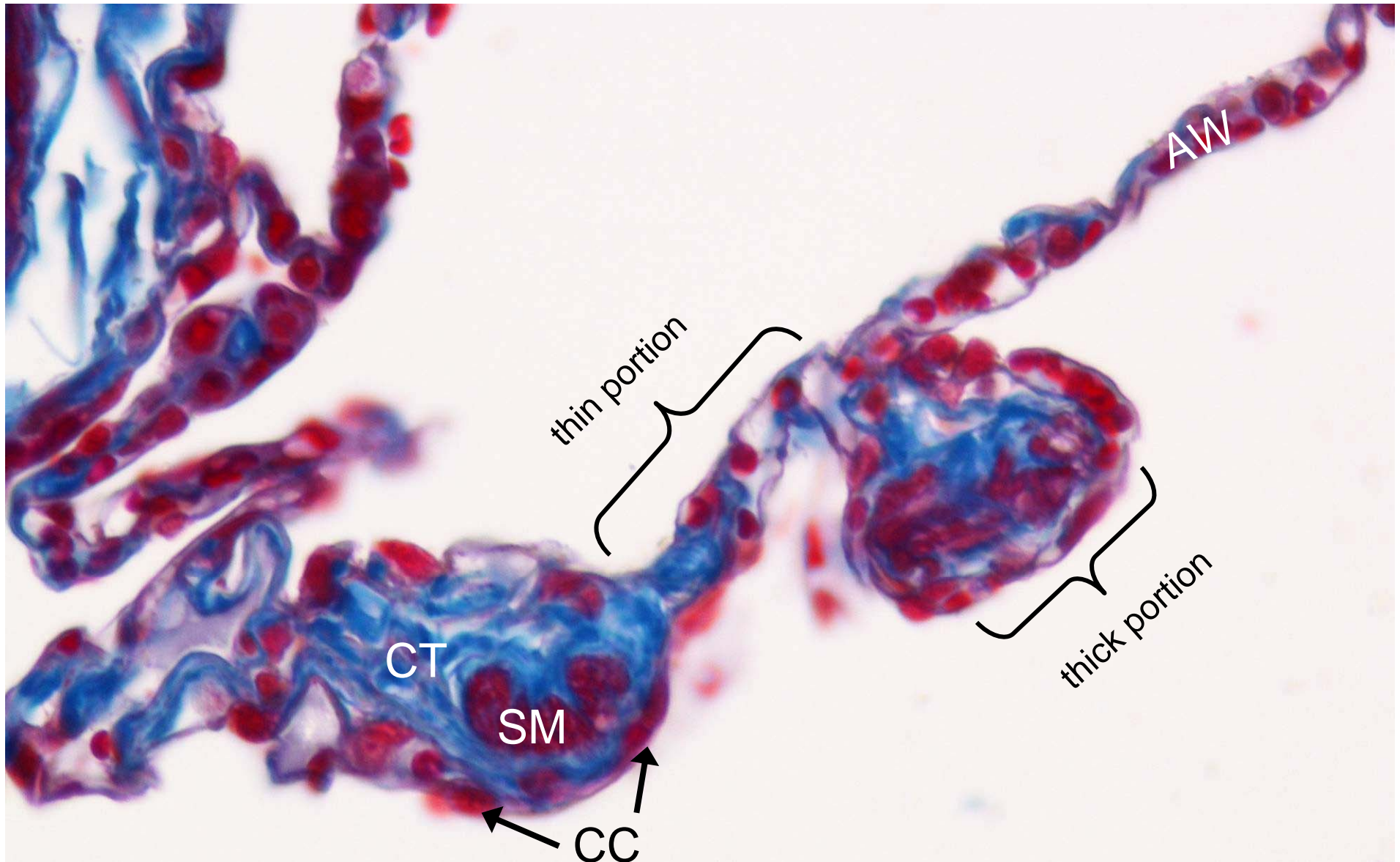


Fig 14. Lung (NO-6-b)

CC: cuboidal cells ; **SM:** smooth muscle
AW: alveolar wall ; **CT:** connective tissue

Fig 14. Lung (NO-6-b)

The wall of the respiratory bronchiole consists of alternating thick and thin portions. The thin portion consists of recesses that have a wall similar to that of the alveoli (A) and thus capable of gas exchange. The thick portion has a wall formed by small cuboidal cells (CC) that appear to rest on a small bundle of smooth muscle (M, eosinophilic material) and is surrounded by a thin investment of connective tissue (CT). The thin regions have a wall similar to the alveolar wall (AW).

Summary

	Mucosa			Submucosa	
	Epithelium		Lamina propria	Glands	Cartilage
Trachea	Pseudo- stratified columnar with cilia	Goblet cells	Thick basement membrane	tracheal glands (mixed glands)	C-shaped hyaline cartilage and trachealis m.
Bronchus	Pseudo- stratified columnar with cilia	Goblet cells	Discontinuous layer of Smooth muscles	Bronchial glands (mixed glands)	Cartilage plates
Bronchiole	Pseudo- stratified columnar with cilia	-	Well developed bundle of smooth mm.	-	-
Terminal bronchioles (not shown in our slides)	Pseudo- stratified columnar with cilia	-	Well developed bundle of smooth mm.	-	-
Respiratory bronchioles	Simple cuboidal	-	Few bundle of smooth mm.	-	-
Alveolar duct	Simple squamous	-	-	-	-
Alveoli	Simple squamous	-	-	-	-