



**Faculty of Biological Science and Technology**  
**Zoology and Botanical Department**  
**Practical Histology**

## **Respiratory System Histology**

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# Respiratory system

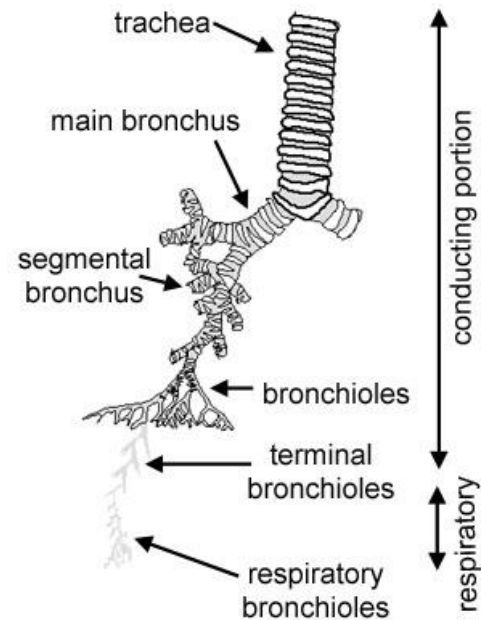
- ▶ Respiratory system composed of ducts and lung which involve in conduction and gas exchange respectively
- ▶ Functionally, respiratory system is divided into two portion including: conductive and respiratory
- ▶ Conductive portions conduct airs to the respiratory portion, where the gas exchange take places

## ▶ **Conductive portion**

- ▶ nasal cavities
- ▶ nasopharynx
- ▶ larynx
- ▶ trachea
- ▶ bronchi
- ▶ bronchioles
- ▶ Terminal bronchioles

## ▶ **Respiratory portion**

- ▶ respiratory bronchioles
- ▶ alveolar ducts
- ▶ alveoli

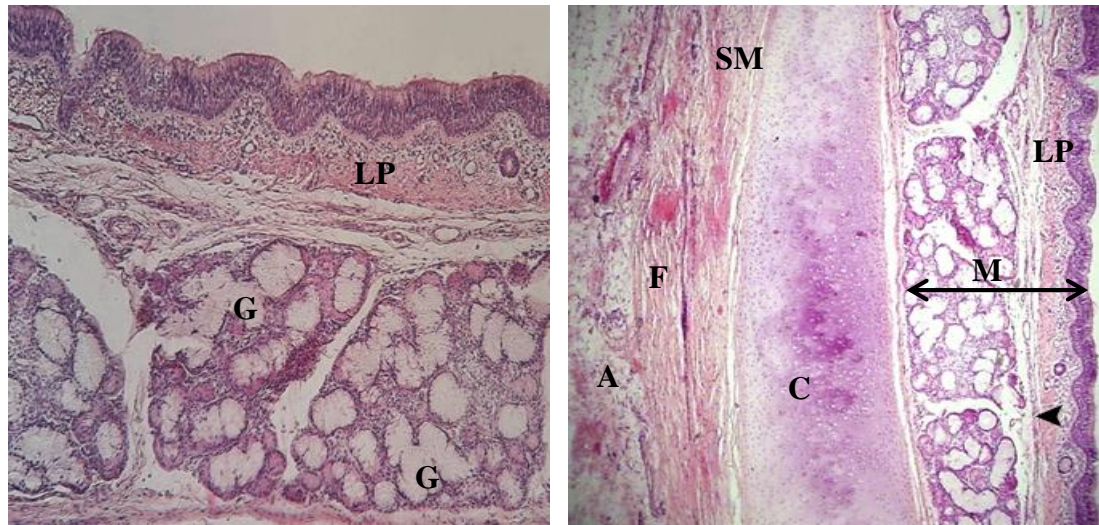


From: [https://www.histology.leeds.ac.uk/respiratory/basic\\_structure.php](https://www.histology.leeds.ac.uk/respiratory/basic_structure.php)



# Trachea

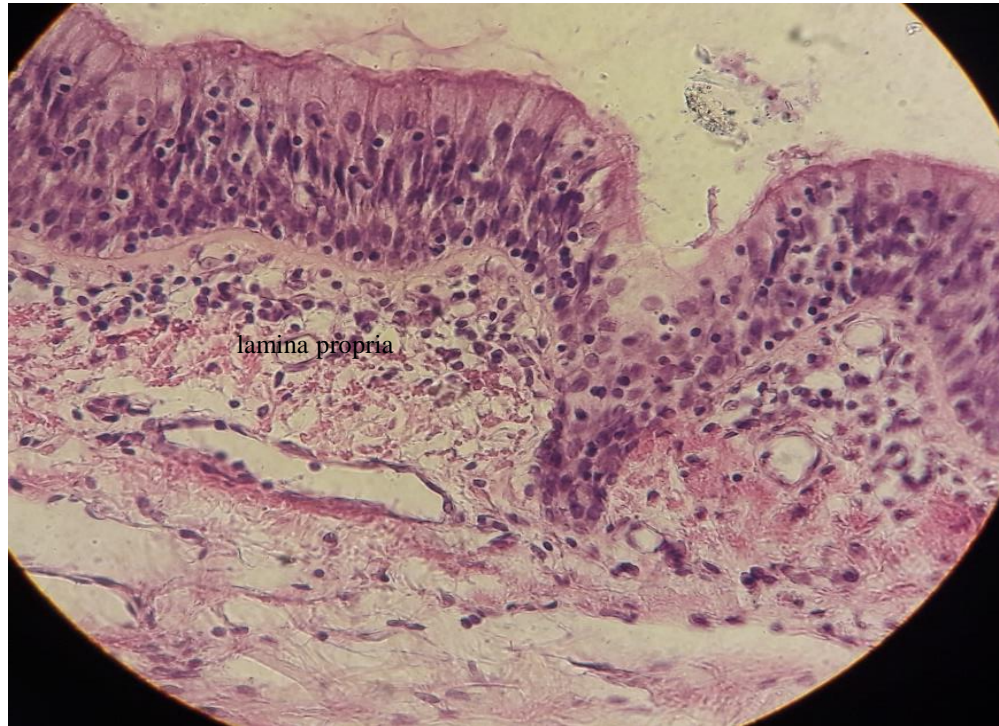
- ▶ Histologically, the wall of trachea consists of four layers: mucosa, submucosa, musculocartilaginous and adventitia
- ▶ The mucosa is the inner layer and lined by ciliated pseudostratified columnar epithelium along with many goblet cells. Scattered lymphoid tissue and sometimes lymphoid nodules can be seen in lamina propria
- ▶ Lamina propria contains mucus gland with serous demilunes
- ▶ Trachea has many C-shaped rings of hyaline cartilage. These rings support the trachea wall and keep it open. They are located in submucosa
- ▶ Dorsally, there is a band of smooth muscle, known as trachealis muscle that connects the free ends of cartilaginous rings
- ▶ The outermost layer of trachea is adventitia which is made of loose connective tissue and connects the trachea to adjacent tissues



Right: cross section of trachea. Mucosa (M), submucosa (SM), hyaline cartilage (C), smooth muscle fibers (F), adventitia (A), lamina propria (LP), elastic fibers, arrow head. H&E, 4X. Left: mucosa of trachea is shown by more magnification. Lamina propria (LP), glands (G). Pseudostratified columnar epithelium is lining mucosa. H&E, 10X. These pictures are taken from histological slide in histology laboratory of Isfahan University



## Trachea mucosa



Ciliated pseudostratified columnar epithelium with underlying lamina propria in the cross section of trachea. H&E, 40X. This picture is taken from histological slide in histology laboratory of Isfahan University



## Trachea: cartilage

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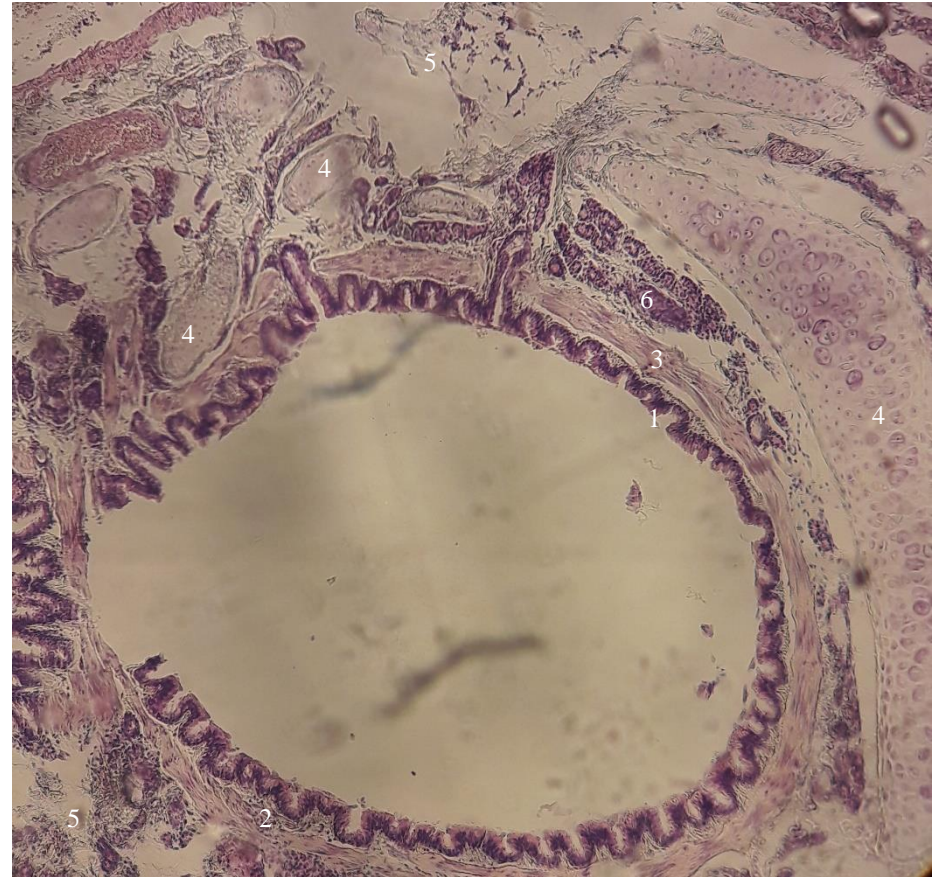


Cross section of trachea. A part of C-shaped cartilage is shown. Tracheal cartilage is of a hyaline cartilage. H&E, 4X. This picture is taken from histological slide in histology laboratory of Isfahan University



## Bronchus

- ▶ Histologically, bronchi are similar to trachea
- ▶ Their mucosa are lined by ciliated, pseudostratified columnar epithelium with scattered goblet cells. Mucosa and submucosa are separated by elastic fibers (which not clearly seen by H&E staining)
- ▶ Cartilaginous plates and muscles support bronchi walls. In the main bronchi, the cartilage is C-shaped, like those in the trachea, while in smaller bronchi, hyaline cartilages are present in irregular shaped like crescent or plates
- ▶ Seromucous glands are present in submucosa layer
- ▶ Bronchi is also surrounded by adventitia

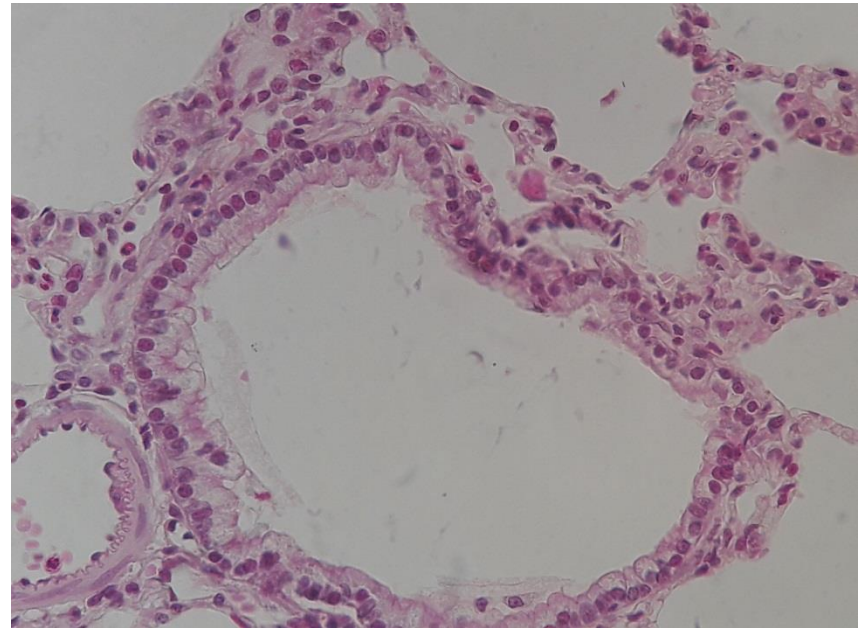


Cross section of bronchus in lung. (1) epithelium, (2) lamina propria, (3) smooth muscle, (4), hyaline cartilage, (5) adventitia, (6) seromucous gland. Folded appearance of bronchus mucosa is due to smooth muscle contraction. H&E, 4X. This picture is taken from histological slide in histology laboratory of Isfahan University



## Bronchioli

- ▶ Bronchioli are the smallest branches of respiratory tract (usually 1 mm in diameter or less). They include terminal bronchioli and respiratory bronchioli
- ▶ There is no distinguished boundary between bronchi and bronchiole
- ▶ There is no cartilage or glands in the wall of bronchiole
- ▶ Their epithelium are ciliated simple columnar with few goblet cells in larger bronchiole and ciliated simple short columnar or cuboid in smaller bronchiole
- ▶ Small clusters of elastic fibers and smooth muscle are present in lamina propria
- ▶ There are thin layer of adventitia around bronchioli

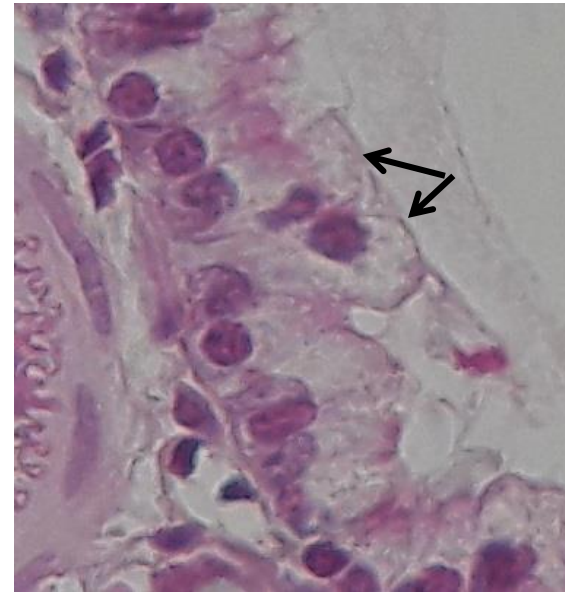


Cross section of bronchiole in lung. H&E, 40X. This picture is taken from histological slide in histology laboratory of Isfahan University



## Club cells

- ▶ Formerly, club cells known as Clara cells
- ▶ Club cells are exocrine epithelial cells, located in the terminal bronchioli
- ▶ They involve in surfactant secretion and also play a detoxifying role
- ▶ Club cells are dome shaped with no cilia and have secretory granules in their apical surfaces

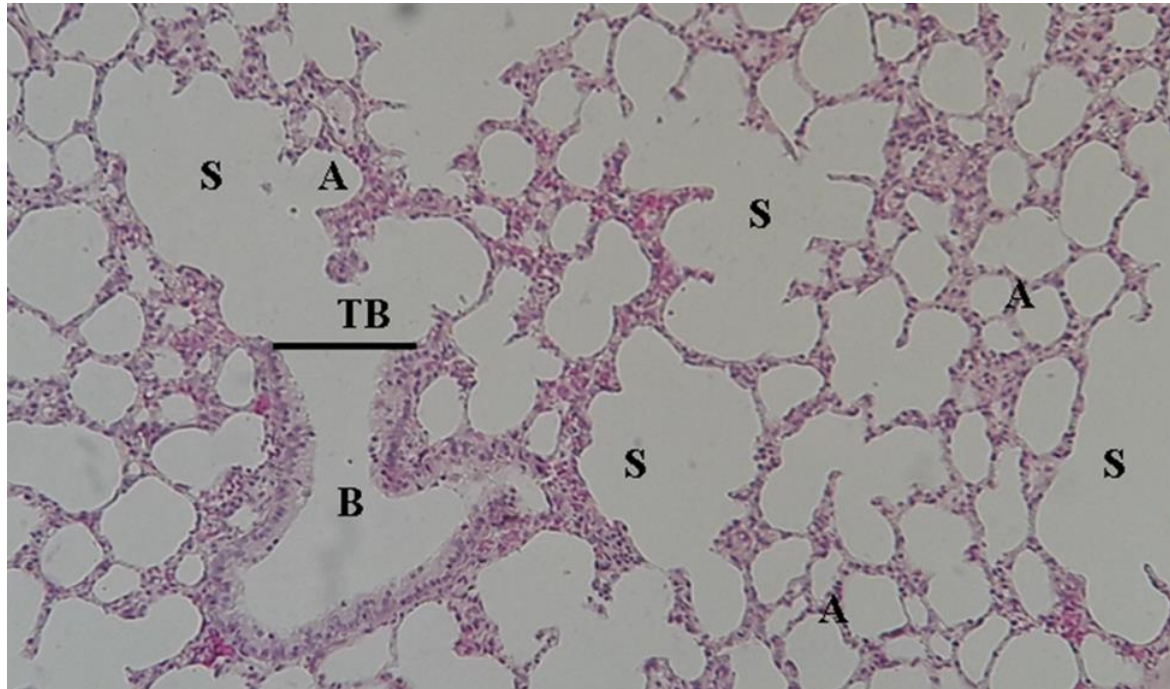


Bronchiole epithelium. Arrows depict club cells. H&E, 100X. This picture is taken from histological slide in histology laboratory of Isfahan University





## Terminal bronchiole

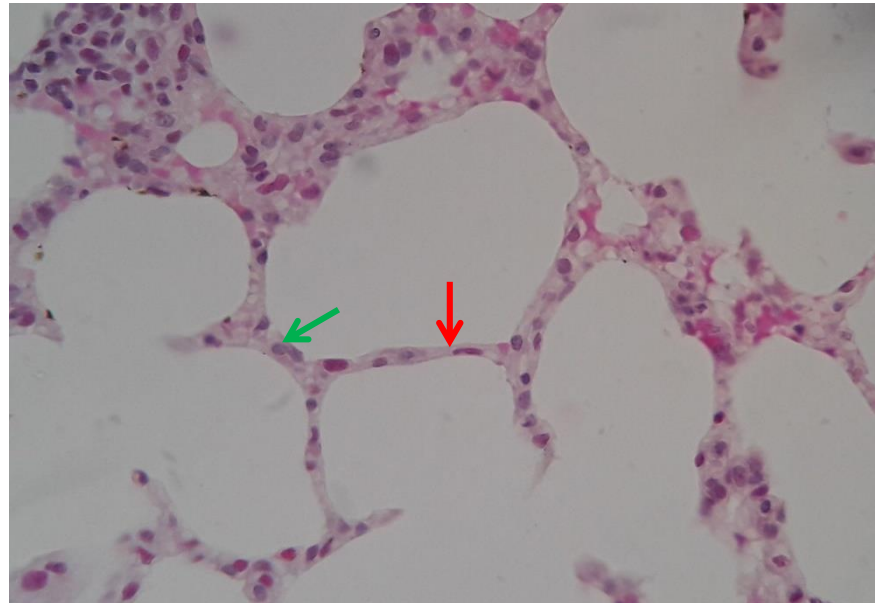


Lung. A larger bronchiole (B) ended to terminal bronchiole (TB). Black line shows the border between bronchiole and terminal bronchiole. Alveoli sacs (S) and alveoli (A) is seen. H&E, 10X. This picture are taken from histological slide in histology laboratory of Isfahan University



## Alveoli

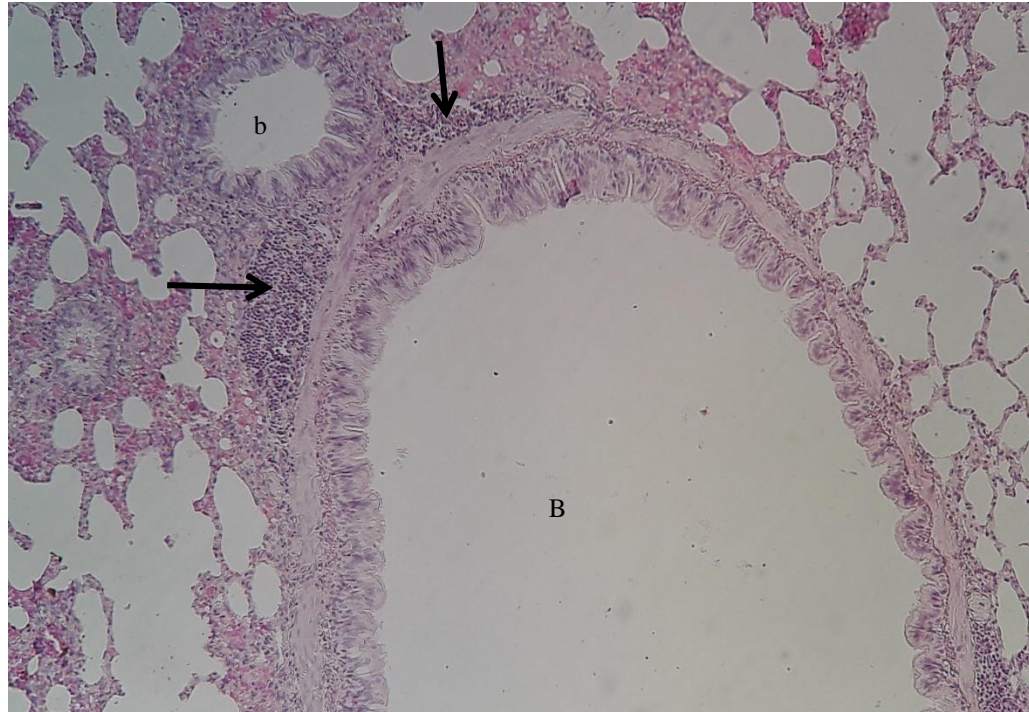
- ▶ Alveolus is the site of gas exchange in lung
- ▶ The alveolar epithelium contains two main cells:
  - ▶ Alveolar cell type I (Type I pneumocyte): squamous cells that line the majority of alveolar wall
  - ▶ Alveolar cell type II (type II pneumocyte): cuboid cells that secrete surfactant



The alveoli in the lung. Alveolar cell type I (red arrow), and alveolar type II (green arrow). H&E, 100X. This picture are taken from histological slide in histology laboratory of Isfahan University



## Lymphoid tissue in lung

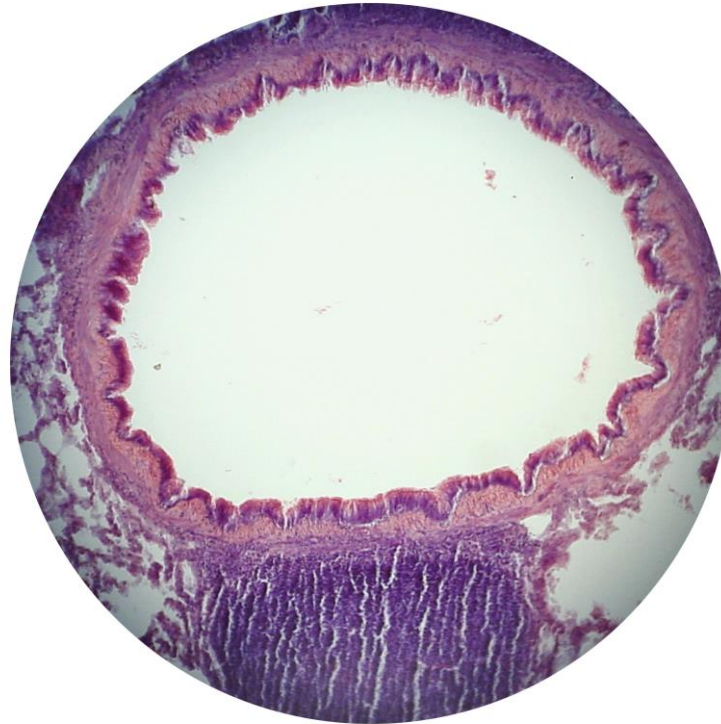


Lymphoid nodules are seen close to a bronchus and bronchiole. Bronchiole (b), Bronchus (B). Lymphoid nodule is shown by black arrow. H&E, 10X. This picture is taken from histological slide in histology laboratory of Isfahan University



## Lymphoid tissue in lung

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Lymphoid nodule is seen close to a bronchiole. H&E, 4X. This picture is taken from histological slide in histology laboratory of Isfahan University