

17 Respiratory System

The goal of this topic is to look and understand the organisation of the conducting and respiratory portions of the respiratory system.

Objectives

You should be able to:

Describe the adaptation of structure to function along the respiratory tract.

Describe the path of air into (O₂) and out of (CO₂) the respiratory system.

Describe the histology throughout the path of air.

Distinguish the histological components of the respiratory tree at all levels.

Recognise and describe the bronchi and bronchioles.

Describe the histological organisation of the alveolar wall.

Describe the morphology and function of specialised cells in the respiratory system.

Slides

Name	Number	Stain
Nostril	71	H/E
Olfactory epithelium	108	H/E
Epiglottis	111	H/E
Trachea	73	H/E
Lung	74	H/E
Lung	72	R/F

Tasks

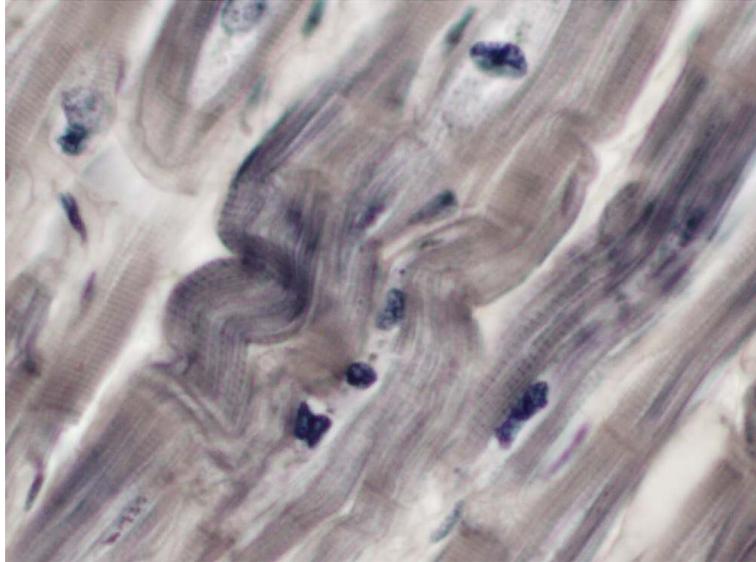
1. Complete the overview section by annotated the supplied images.
2. Complete the tasks for each of the slides.
3. Complete the Questions section. Remember to focus on Histology, but make elaborative connections to relevant material from other subjects.

Slide 71: Nostril – section through the nostril (H/E)

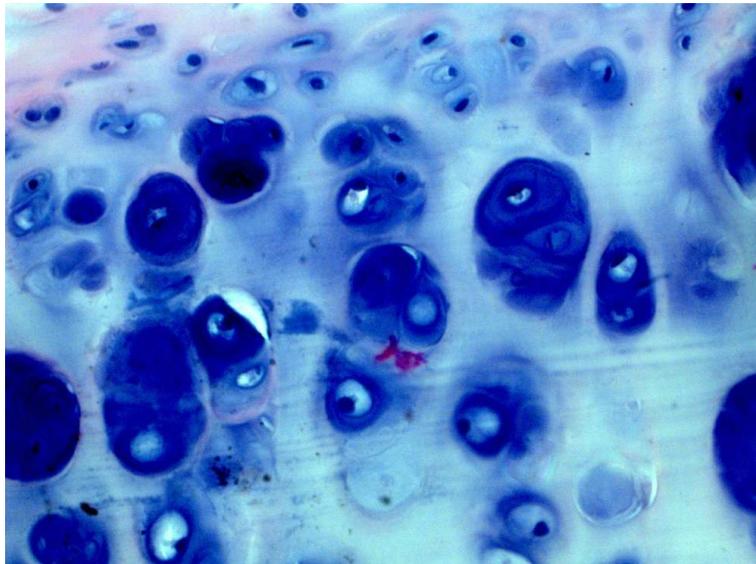
1. View the slide under low magnification. You should see unbroken and uninterrupted internal and external surfaces, as well as the broken attachment area.

- | |
|---|
| <ol style="list-style-type: none">1. Give a complete classification of epithelia. Consider cellular arrangements, layering and types of secretions. Give an example of each, as well as the function of each. |
|---|

2. Identify the tissue seen on this slide:



3. Identify the tissue seen on this slide:



4. Name two other examples of each of types of tissues identified above.

2. Identify the internal and external surfaces of the nostril.

1. Explain epithelial transitions with specific reference to the nose, mouth and anus.
2. What is a diagnostic difference between squamous epithelium covering internal and external surfaces?

3. Identify each of the layers expected between the internal and external surfaces of the nostril.

1. What are the difference between the hair and sebaceous glands of the skin and vestibulum?

2. What type of cartilage is seen in the nostril?

4. Make an annotated line diagram, indicating the position and relative thickness of the following structures:
- Skin and hypodermis
 - Muscle
 - Cartilage
 - Skin and hypodermis

Slide 108: Olfactory epithelium – a section through the olfactory epithelium of the respiratory section of the nasal cavity of an embryo (H/E)

1. View the slide at a low magnification.

1. List the cavities, spaces and openings associated with the nose, nostril, nasal cavity, olfactory epithelium and oral cavity.
2. For each of the structures listed above, list the associated epithelium.
3. Name the macroscopic structures underlying the epithelia listed above.

2. On the slide, at a low magnification, identify the following macroscopic structures:
- Nasal septum
 - Nasal cavities
 - Conchae
3. View the slide at higher magnifications.
4. Identify the following microscopic structures:
- Olfactory epithelium
 - Lamina propria

1. What glands are associated with the nose and nasal cavity externally and internally?
2. What cells constitute the olfactory epithelium?
3. List each of the following in relation to the olfactory epithelium and provide a function for each item listed: Cells, tissues, organs and structures.
4. What structure underlies the lamina propria?

5. Make an annotated drawing of the olfactory epithelium. Show the glands of Bowman and the lamina propria.

Slide 111: Epiglottis – sagittal section through the epiglottis (H/E)

1. View the slide at a low magnification.
2. Identify the various surfaces of the epiglottis.

3. View the slide at a higher magnification.
4. Identify the following microscopic structures:
 - Epithelium of the anterior surface.
 - Epithelium of the posterior surface.
 - Lamina propria
 - Cartilage
5. Make an annotated line drawing to show the different tissues comprising the epiglottis.

1. How does the anterior and posterior surfaces differ with regards to their mucosal layers?
2. What is distinctive in the lamina propria?
3. What type of cartilage is found in the epiglottis?

Slide 73: Trachea – a cross section through the trachea (H/E)

1. View the slide at very low magnification. You should be able to see the opening of the trachea, layers of the trachea and surrounding adventitia.

1. Describe the anatomy of the trachea and its relationships in the thorax.
2. List the epithelium of the respiratory system, starting at the nasal cavity and follow all surfaces into the alveolus.

2. Identify the following:
 - Epithelium
 - Lamina propria
 - Submucosa
 - Cartilage
 - Muscle
 - Adventitia

1. Name the epithelium found in the trachea.
2. List the component cells of the tracheal epithelium and the function of each cell.

3. View the slide at a higher magnification. Identify the different layers seen macroscopically.

1. What are two prominent structures in the lamina propria?
2. What prominent structures are found in the submucosa?

4. Make an annotated line drawing of the trachea and its layers.

1. What cartilage is found in the trachea?
2. What type of contractile tissue are seen in the trachea?
3. Where is the contractile tissue located in the trachea?

5. Make an annotated line drawing of the epithelium of the trachea and its constituent cells.

Slide 74: Lung – a section through the lung (H/E)

Slide 72: Lung – a section through the lung illustrating the elastic fibres (R/F)

1. View the slide of the lung at a low magnification. The pleura of the lung should be visible.
2. At a low magnification, identify the following:
 1. The lung tissue
 2. Pleura of the lung
 3. Bronchi
 4. Bronchiole
 5. Respiratory bronchiole
 6. Ductuli and sacculae alveolares
 7. Alveoli
 8. Elastic fibres

1. Name the branching structures of the lung passages, starting with the trachea all the way to a single alveolus. For each structure, indicate if this is a conducting or respiratory part.
2. What is essential, structurally, for gas exchange to take place?
3. What characteristic maximizes gas exchange?
4. Which structures are difficult to identify at lower magnifications?

3. View the slide at a higher magnification. Identify the structures listed above, paying close attention to their microscopic structure.

1. Describe the overall impression of lung tissue in a short sentence.
2. What type of tissue forms the pleura?
3. How would you differentiate between bronchi, bronchiole and respiratory bronchiole?

4. Identify the blood-air barrier.

1. Name and describe other barrier systems present in the body.
2. How do these other barrier systems differ structurally and functionally from the blood-air barrier?

5. Make and annotated drawing of the bronchi, bronchiole and alveoli. Indicate where elastic elements occur.

1. What are distinguishing characteristics of ductuli and sacculae alveolares and alveoli?
2. Where are elastic fibres found?
3. Where are smooth muscle found?
4. What are Clara cells? Is this the correct term? If not, what is the correct term?

Questions

Focusing on histology, complete the following:

1. Study the supplied diagrams and slides (see HistoWeb). Annotate each. Where possible, give the function of each labelled structure or cell.
2. Complete the following table:

Component	Epithelium	Secretory Cell	Cartilage	Sm. Muscle	Glands in C. T.	Diameter	Other
Trachea							
Bronchi							
Bronchioles to Terminal Bronchioles							
Respiratory Bronchioles							
Alveolar Duct							
Alveoli							

3. Describe the path of oxygen from outside the body until it takes part in a metabolic process, and the corresponding reverse path followed by carbon dioxide.
4. Make an annotated diagram of the complete respiratory system, indicating the function of each part.
5. Describe the histology seen in a cross-section for each of the following passages of the respiratory system:

1. Nasal cavities
 2. Trachea
 3. Bronchioles
 4. Respiratory bronchioles
 5. Alveolar duct
 6. Alveoli
6. List the functions of each part of the respiratory system.
 7. Name the cells present in each part of the respiratory system and the function of each.
 8. Make an annotated diagram of the blood-air barrier, clearly indicating the components and surrounding cells and tissues.
 9. Correlate each of the described histological structures with its corresponding view on a microscopic slide.
 10. Complete the tasks for each slides in the practical workbook or your portfolio book.
 11. Dry air consist of 78% nitrogen, 21% oxygen, and 1% argon, carbon dioxide, and other gases. Air also contains a variable amount of water vapour. Gas exchange by diffusion in the alveoli within the lungs changes these proportions. The composition of inhaled and exhaled air is different. How much oxygen is absorbed by the lungs? What happens with nitrogen? Carbon monoxide is toxic on inhalation. Nitrogen is not. Describe the two mechanisms at work.
 12. Compare and contrast the conducting and respiratory zones.
 13. Complete the following:
Inhaled air contains:
 - _____ oxygen used to create _____ and
 - _____ carbon dioxide than...Exhaled air which contains:
 - _____ carbon dioxide produced as _____ of _____ and
 - _____ oxygen as it has been used in _____.