

CHAPTER 4: RESPIRATORY SYSTEM

Building a Medical Terminology Foundation 2e by Kimberlee Carter; Marie Rutherford; and Connie Stevens

- 4.1 – Introduction to the Respiratory System
- 4.2 – Anatomy (Structures) of the Respiratory System
- 4.3 – Physiology (Function) of the Respiratory System
- 4.4 – Respiratory Diseases and Disorders
- Vocabulary & Check Your Knowledge
- References

Except where otherwise noted, this OER is licensed under CC BY 4.0 (<https://creativecommons.org/licenses/by/4.0/>)

Please visit the web version of *Building a Medical Terminology Foundation 2e* (<https://ecampusontario.pressbooks.pub/medicalterminology2/>) to access the complete book, interactive activities and ancillary resources.

4.1 - Introduction to the Respiratory System

Learning Objectives

- Identify the anatomy and describe the main functions of the respiratory system
- Analyze, translate, and define medical terms and common abbreviations of the respiratory system
- Practice the spelling and pronunciation of respiratory system terminology
- Identify the medical specialties associated with the respiratory system and explore common diseases, disorders, diagnostic testing and procedures related to the respiratory system

Respiratory System Word Parts

Click on prefixes, combining forms, and suffixes to reveal a list of word parts to memorize for the respiratory system

Respiratory System Medical Terms (Text Version)

Prefix

- **a-** (absence of, without)
- **an-** (absence of, without)
- **dys-** (difficult, painful, abnormal, laboured)
- **endo-** (Gr. within, in)
- **eu-** (normal, good)
- **hyper-** (above, excessive)
- **hypo-** (below, deficient, under)
- **intra-** (L. within, in)
- **poly-** (many, much)

- **tachy-** (fast, rapid)

Combining Form

- **adenoid/o** (adenoids)
- **alveol/o** (alveolus)
- **atel/o** (imperfect, incomplete)
- **bronch/o** (bronchus)
- **bronchi/o** (bronchus)
- **capn/o** (carbon dioxide)
- **diaphragmat/o** (diaphragm)
- **epiglott/o** (epiglottis)
- **hem/o** (blood)
- **hemat/o** (blood)
- **laryng/o** (larynx)
- **lob/o** (lobe)
- **muc/o** (mucus)
- **nas/o** (nose)
- **orth/o** (straight)
- **ox/i** (oxygen)
- **pharyng/o** (pharynx)
- **phon/o** (sound, voice)
- **phren/o** (diaphragm)
- **pleur/o** (pleura)
- **pneum/o** (lung, air)
- **pneumon/o** (lung, air)
- **penumat/o** (lung)
- **pulmon/o** (lung)
- **py/o** (pus)
- **radi/o** (x-rays, ionizing radiation)
- **respir/o** (breath, breathing)
- **rhin/o** (nose)
- **sept/o** (septum)
- **sinus/o** (sinus)
- **somn/o** (sleep)
- **son/o** (sound)
- **spir/o** (breathe, breathing)
- **thorac/o** (thorax, chest cavity, thoracic cavity)
- **tom/o** (to cut, section, slice)
- **tonsill/o** (tonsil)
- **trache/o** (trachea)

Suffix

- **-algia** (pain)
- **-ar** (pertaining to)
- **-ary** (pertaining to)
- **-cele** (hernia, protrusion)
- **-centesis** (surgical puncture to aspirate fluid)
- **-eal** (pertaining to)
- **-ectasis** (stretching out, dilation, expansion)
- **-emia** (in the blood)
- **-gram** (the record, radiographic image)
- **-graph** (instrument used to record)
- **-graphy** (process of recording, radiographic imaging)
- **-meter** (instrument used to measure)
- **-metry** (measurement)
- **-pexy** (surgical fixation, suspension)
- **-pnea** (breathing)
- **-rrhagia** (rapid flow of blood, excessive bleeding)
- **-scope** (instrument used for visual examination)
- **-scopic** (pertaining to visual examination)
- **-scopy** (process of visually examining, visual examination)
- **-spasm** (sudden involuntary muscle contraction, spasmodic contraction)
- **-stenosis** (constriction, narrowing)
- **-stomy** (creation of an artificial opening)
- **-thorax** (chest, chest cavity, thoracic cavity)
- **-tomy** (cut into, incision)
- **-itis** (inflammation)
- **-ectomy** (excision, cut out)
- **-tome** (instrument used to cut)
- **-genic** (producing, originating, causing)
- **-ic** (pertaining to)
- **-ia** (condition, diseased state, abnormal state)
- **-plasty** (surgical repair)
- **-oid** (resembling)
- **-logy** (study of)
- **-logist** (specialist or physician who studies and treats)

Activity source: Respiratory System Word Parts by Kimberlee Carter, licensed under CC BY 4.0./Text version added.

Introduction to the Respiratory System

How long you can hold your breath as you continue reading? How long can you do it? Chances are you are feeling

uncomfortable already. A typical human cannot survive without breathing for more than three minutes, and even if you wanted to hold your breath longer, your **autonomic** nervous system would take control. Although oxygen is critical for cells, it is the accumulation of carbon dioxide that primarily drives your need to breathe.

Did You Know?

If you hold your breath for longer than 3 minutes, your autonomic nervous system will take control.

The major structures of the respiratory system function primarily provide oxygen to body tissues for cellular respiration, remove the waste product carbon dioxide, and help to maintain acid-base balance. Portions of the respiratory system are also used for non-vital functions, such as sensing odors, speech production, and for straining, such as coughing.

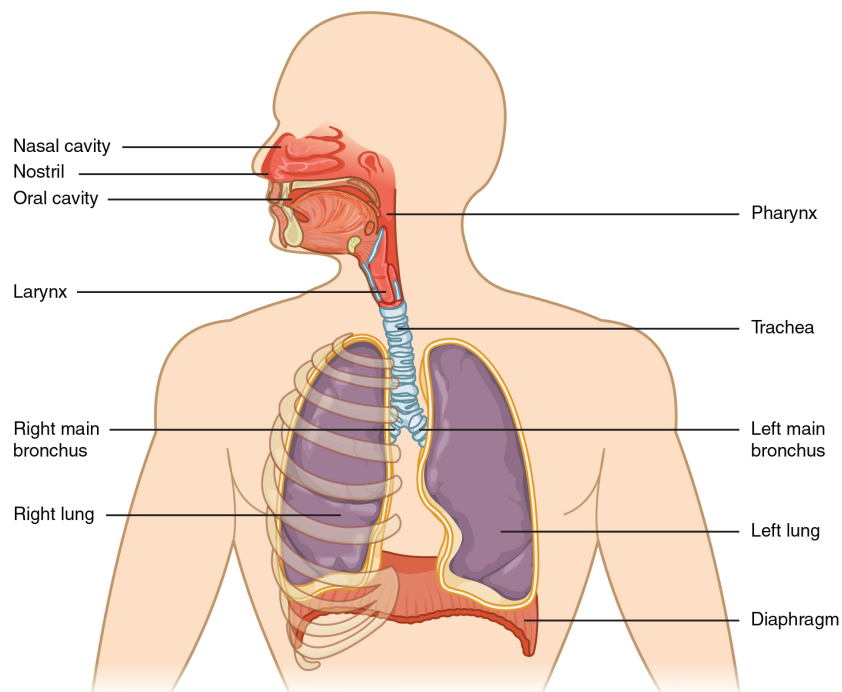


Figure 4.1 Major Respiratory Structures. The major respiratory structures span the nasal cavity to the diaphragm. From Betts, et al., 2013. Licensed under CC BY 4.0. [Fig. 4.1 Image description.]

Watch Respiratory system, Part 1: Crash Course Anatomy & Physiology #31 (10 min on YouTube)
(<https://youtu.be/bHZsvBdUC2I>)

Respiratory System Medical Terms

Respiratory System Medical Terms (Text version)

1. **Adenoiditis**

- adenoid/itis
- inflammation of the adenoids

2. **adenoidectomy**

- adenoid/ectomy
- excision of the adenoids

3. **adenotome**

- aden/o/tome
- instrument used to cut the adenoids

4. **alveolitis**

- alveol/itis
- inflammation of the alveoli

5. **alveolar**

- alveol/ar
- pertaining to the alveolus

6. **atelectasis**

- atel/ectasis
- incomplete expansion

7. **bronchitis**

- bronch/itis
- inflammation of the bronchus

8. **bronchogenic carcinoma**

- bronch/o/genic carcin/oma
 - cancerous tumour originating in a bronchus (lung cancer)
9. **bronchopneumonia**
- bronch/o/pneumon/ia
 - diseased state of bronchi and lungs
10. **bronchoplasty**
- bronch/o/plasty
 - surgical repair of the bronchi
11. **bronchoscope**
- bronch/o/scope
 - instrument used for visual examination of the bronchi
12. **bronchoscopy**
- bronch/o/scopy
 - visual examination of the bronchi
13. **bronchoalveolar**
- bronch/o/alveol/ar
 - pertaining to the bronchi and alveoli
14. **bronchospasm**
- bronch/o/spasm
 - spasmodic contraction of the bronchi
15. **bronchiectasis**
- bronchi/ectasis
 - dilation of the bronchi
16. **capnometer**
- capn/o/meter
 - instrument used to measure carbon dioxide
17. **acapnia**
- a/capn/ia
 - condition of absence (less than normal level) of carbon dioxide (in the blood)
18. **hypercapnia**

- hyper/capn/ia
 - condition of excessive (greater than normal levels) carbon dioxide (in the blood)
19. **hypocapnia**
- hypo/capn/ia
 - condition of deficient (low levels) of carbon dioxide (in the blood)
20. **diaphragmatocele**
- diaphragmat/o/cele
 - hernia of the diaphragm
21. **diaphragmatic**
- diaphragmat/ic
 - pertaining to the diaphragm
22. **epiglottitis**
- epiglott/itis
 - inflammation of the epiglottis
23. **hemothorax**
- hem/o/thorax
 - blood in the thoracic cavity
24. **hematology**
- hemat/o/logy
 - study of blood
25. **hematologist**
- hemat/o/logist
 - specialist in blood and blood disorders
26. **laryngotracheobronchitis (LTB)**
- laryng/o/trache/o/bronch/itis
 - inflammation of the larynx, trachea, and bronchi
27. **laryngoplasty**
- laryng/o/plasty
 - surgical repair of the larynx
28. **laryngostomy**
- laryng/o/stomy

- creation of an artificial opening into the larynx
29. **laryngotracheotomy**
- laryng/o/trache/o/tomy
 - incision into the larynx and trachea
30. **laryngoscope**
- laryng/o/scope
 - instrument used for visual examination of the larynx
31. **laryngoscopy**
- laryng/o/scopy
 - process of viewing the larynx
32. **laryngeal**
- laryng/eal
 - pertaining to the larynx
33. **laryngospasm**
- laryng/o/spasm
 - spasmodic contraction of the larynx
34. **laryngitis**
- laryng/itis
 - inflammation of the larynx
35. **lobar pneumonia**
- lob/ar pneumon/ia
 - disease state of the lung pertaining to the lobe(s)
36. **lobectomy**
- lob/ectomy
 - excision of the lobe(s)
37. **muroid**
- muc/oid
 - resembling mucus
38. **mucous**
- muc/ous
 - pertaining to mucus

39. **nasopharyngitis**
- nas/o/pharyng/itis
 - inflammation of the nose and pharynx
40. **nasopharyngeal**
- nas/o/pharyng/eal
 - pertaining to the nose and pharynx
41. **orthopnea**
- orth/o/pnea
 - breathing is easier in a straight position
42. **anoxia**
- an/ox/ia
 - condition of absence (deficiency) of oxygen
43. **oximeter**
- oxi/meter
 - instrument used to measure oxygen
44. **hypoxemia**
- hyp/ox/emia
 - condition of deficient oxygen in the blood
45. **hypoxia**
- hyp/ox/ia
 - condition of deficient oxygen
46. **pharyngitis**
- pharyng/itis
 - inflammation of the pharynx
47. **aphonia**
- a/phon/ia
 - condition of absence of voice
48. **dysphonia**
- dys/phon/ia
 - condition of difficult speaking (voice)
49. **phrenalgia**

- phren/algia
 - pain in the diaphragm
50. **phrenospasm**
- phren/o/spasm
 - spasm of the diaphragm
51. **pleuritic**
- pleurit/ic
 - pertaining to the pleura
52. **pleuritis**
- pleur/itis
 - inflammation of the pleura
53. **pleuropexy**
- pleur/o/pexy
 - surgical fixation of the pleura
54. **interpleural**
- inter/pleur/al
 - pertaining to between the pleura (space between the pleural membranes)
55. **pneumoconiosis**
- pneum/o/coni/osis
 - abnormal condition of dust in the lungs
56. **pneumonia**
- pneumon/ia
 - diseased state of lung
57. **pneumonitis**
- pneumon/itis
 - inflammation of the lung
58. **pneumothorax**
- pneum/o/thorax
 - air in the thoracic cavity
59. **pneumonectomy**
- pneumon/ectomy

- excision of the lung
- 60. **pneumatocele**
 - pneumat/o/cele
 - hernia of the lung
- 61. **pulmonary**
 - pulmon/ary
 - pertaining to the lung(s)
- 62. **pyothorax**
 - py/o/thorax
 - pus in the thoracic cavity
- 63. **radiography**
 - radi/o/graphy
 - process of recording x-rays
- 64. **radiologist**
 - radi/o/logist
 - physician who specializes in the diagnosis and treatment of disease using medical imaging
- 65. **radiology**
 - radi/o/logy
 - study of the use of radiant energy in diagnosing disease
- 66. **respirologist**
 - respir/o/logist
 - specialist who studies and treats disease and disorders related to breathing
- 67. **respirology**
 - respir/o/logy
 - the study of breathing disorders and disease
- 68. **rhinitis**
 - rhin/itis
 - inflammation of the nose
- 69. **rhinomycosis**
 - rhin/o/myc/osis
 - abnormal condition of fungus in the nose

70. **rhinorrhagia**
- rhin/o/rrhagia
 - rapid flow of blood from the nose
71. **rhinoplasty**
- rhin/o/plasty
 - surgical repair of the nose
72. **rhinorrhea**
- rhin/o/rrhea
 - discharge from the nose
73. **septoplasty**
- sept/o/plasty
 - surgical repair of the septum
74. **septotomy**
- sept/o/tomy
 - incision into the (nasal) septum
75. **sinusitis**
- sinus/itis
 - inflammation of a sinus
76. **polysomnography (PSG)**
- poly/somn/o/graphy
 - process of recording many (test) during sleep
77. **sonogram**
- son/o/gram
 - the record of sound
78. **sonography**
- son/o/graphy
 - process of recording sound
79. **spirometer**
- spir/o/meter
 - instrument used to measure breathing (lung volume)
80. **spirometry**

- spir/o/metry
 - measuring breathing (air flow)
81. **thoracalgia**
- thorac/algia
 - pain in the chest, thorax
82. **thoracocentesis**
- thorac/o/centesis
 - surgical puncture to aspirate fluid (from the thoracic cavity)
83. **thoracentesis**
- thora/centesis
 - surgical puncture to aspirate fluid from thoracic cavity
84. **thoracotomy**
- thorac/o/tomy
 - incision into the thoracic cavity
85. **thoracoscopy**
- thorac/o/scopy
 - visual examination of the thoracic cavity
86. **thoracic**
- thorac/ic
 - pertaining to the chest, thorax
87. **thoracoscope**
- thorac/o/scope
 - instrument used to visualize the thoracic cavity
88. **tomography**
- tom/o/graphy
 - process of recording slices
89. **tonsillitis**
- tonsill/itis
 - inflammation of the tonsils
90. **tonsillectomy**
- tonsill/ectomy

- excision of the tonsils
91. **tracheitis**
- trache/itis
 - inflammation of the trachea
92. **tracheoplasty**
- trache/o/plasty
 - surgical repair of the trachea
93. **tracheostomy**
- trache/o/stomy
 - creation of an artificial opening into the trachea
94. **tracheotomy**
- trache/o/tomy
 - incision into the trachea
95. **endotracheal**
- endo/trach/eal
 - pertaining to within the trachea
96. **tracheostenosis**
- trache/o/stenosis
 - narrowing of the trachea
97. **endoscope**
- endo/scope
 - instrument used to view within
(a hollow organ or cavity)
98. **endoscopic**
- endo/scopic
 - pertaining to view within
(a hollow organ or cavity)
99. **endoscopy**
- endo/scopy
 - visual examination within
(a hollow organ or cavity)
100. **apnea**

- a/pnea
- absence of breathing

101. **dyspnea**

- dys/pnea
- breathing that is difficult

102. **eupnea**

- eu/pnea
- normal breathing

103. **hypopnea**

- hypo/pnea
- deficient breathing

104. **tachypnea**

- tachy/pnea
- rapid breathing

Activity Source: Respiratory System Medical Terms by Kimberlee Carter, licensed under CC BY 4.0./Text version added.

Image Descriptions

Figure 4.1 image description: This figure shows the upper half of the human body. The major organs in the respiratory system are labeled. [Return to Figure 4.1].

Attribution

Except where otherwise noted, this chapter is adapted from “Respiratory System (<https://ecampusontario.pressbooks.pub/medicalterminology/chapter/respiratory-system/>)” in *Building a Medical Terminology Foundation* by Kimberlee Carter and Marie Rutherford licensed under CC BY 4.0. / A derivative of Betts et al., which can be accessed for free from *Anatomy and Physiology (OpenStax)* (<https://openstax.org/books/anatomy-and-physiology/pages/1-introduction>). Adaptations: dividing Respiratory System chapter content into sub-chapters.

4.2 - Anatomy (Structures) of the Respiratory System

The Nose and its Adjacent Structures

The major entrance and exit for the respiratory system is through the **nose**. When discussing the nose, it is helpful to divide it into two major sections:

- **external nose**
- **internal nose**

The **nares** open into the nasal cavity, which is separated into left and right sections by the nasal septum (Figure 4.2). The **nasal septum** is formed anteriorly by a portion of the **septal cartilage** and posteriorly by the perpendicular plate of the ethmoid bone and the thin vomer bones.

Each lateral wall of the nasal cavity has three bony projections the inferior conchae are separate bones and the superior and middle conchae are portions of the ethmoid bone. **Conchae** increase the surface area of the nasal cavity and disrupt the flow of air as it enters the nose, causing air to bounce along the epithelium, where it is cleaned and warmed. The conchae and meatuses trap water during exhalation preventing dehydration.

The floor of the nasal cavity is composed of the **hard palate** and the **soft palate**. Air exits the nasal cavities via the internal nares and moves into the pharynx.

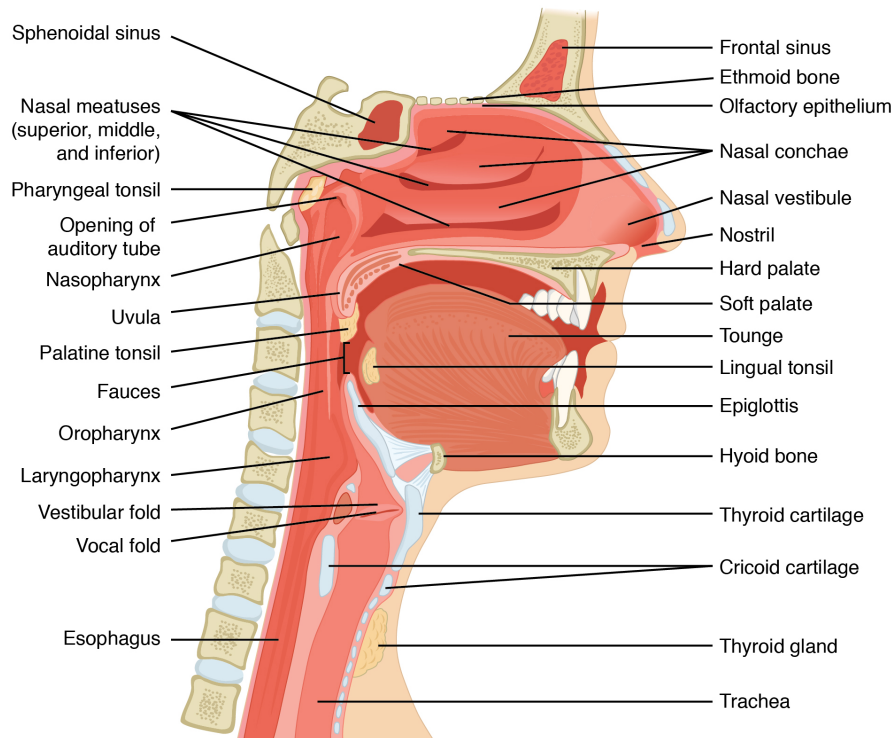


Figure 4.2 Upper Airway. From Betts, et al., 2013. Licensed under CC BY 4.0. [Fig. 4.2 Image description.]

Paranasal sinuses serve to warm and humidify incoming air and are lined with a mucosa which produces mucus. Paranasal sinuses are named for their associated bone:

- frontal sinus
- maxillary sinus
- sphenoidal sinus
- ethmoidal sinus

The nares and anterior portion of the nasal cavities are lined with mucous membranes, containing sebaceous glands and hair follicles that serve to prevent the passage of large debris, such as dirt, through the nasal cavity. An olfactory epithelium used to detect odors is found deeper in the nasal cavity.

The conchae, meatuses, and paranasal sinuses are lined by respiratory epithelium composed of pseudostratified ciliated columnar epithelium (Figure 4.3). The epithelium contains specialized epithelial cells that produce mucus to trap debris. The cilia of the respiratory epithelium help to remove mucus and debris with a constant beating motion, sweeping materials towards the throat to be swallowed.

This moist epithelium functions to warm and humidify incoming air. Capillaries located just beneath the nasal epithelium warm the air by convection. Serous and mucus-producing cells also secrete **defensins**, immune cells patrol the connective tissue providing additional protection.

Did You Know 1?

Cold air slows the movement of cilia that may result in the accumulation of mucus leading to **rhinorrhea** during cold weather.

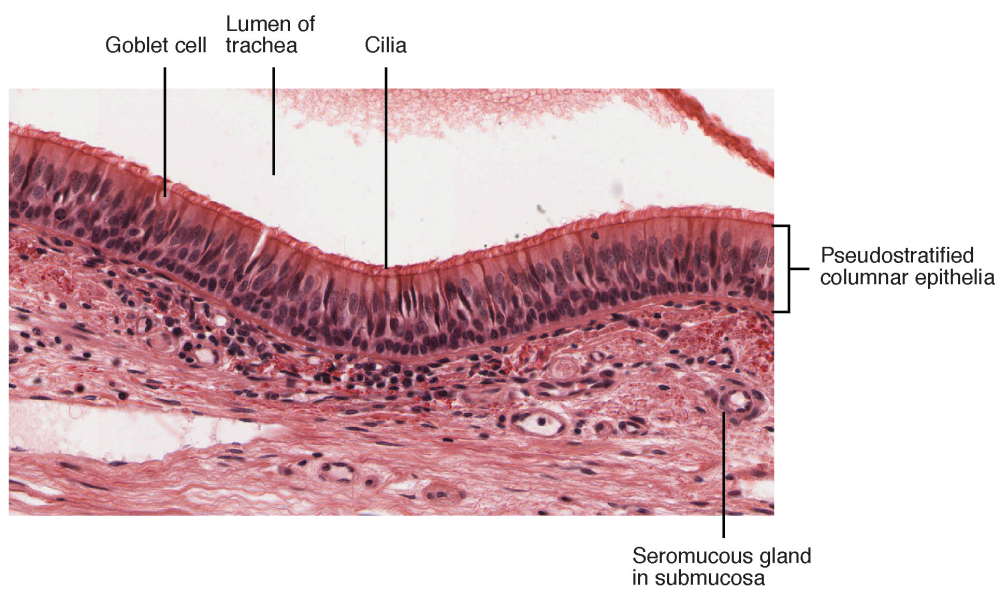


Figure 4.3 Pseudostratified Ciliated Columnar Epithelium. Respiratory epithelium is pseudostratified ciliated columnar epithelium. Seromucous glands provide lubricating mucus. LM \times 680. (Micrograph provided by the Regents of University of Michigan Medical School \copyright 2012). From Betts, et al., 2013. Licensed under CC BY 4.0. [Fig. 4.3 Image description.]

Pharynx

The **pharynx** is divided into three major regions: the **nasopharynx**, the **oropharynx**, and the **laryngopharynx** (see Figure 4.4).

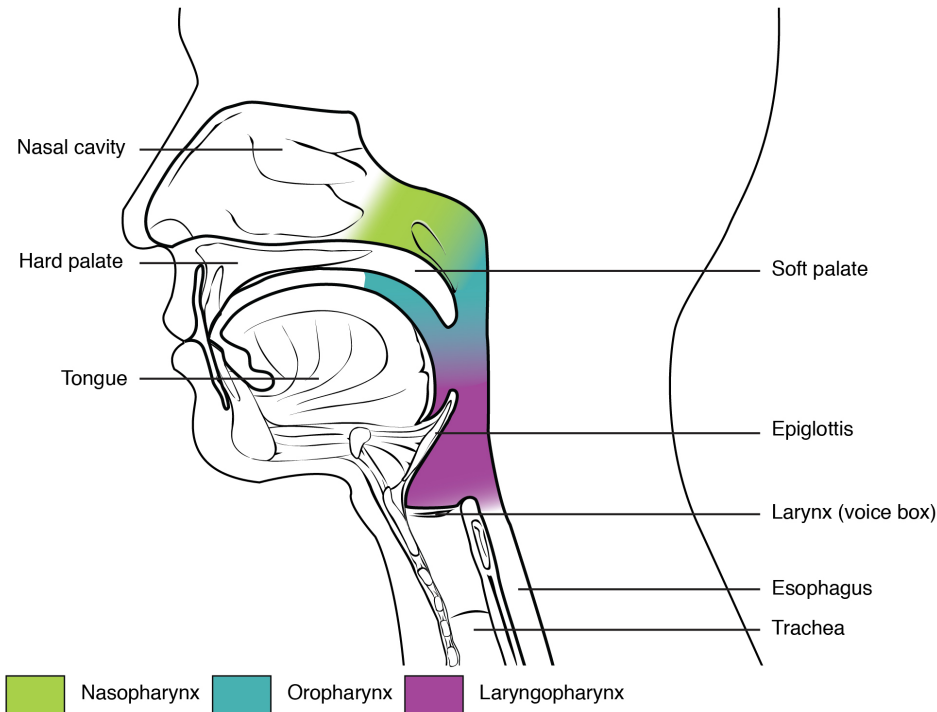


Figure 4.4 Divisions of the Pharynx. The pharynx is divided into three regions: the nasopharynx, the oropharynx, and the laryngopharynx. From Betts, et al., 2013. Licensed under CC BY 4.0. [Fig. 4.4 Image description.]

At the top of the **nasopharynx** are the pharyngeal tonsils. The function of the **pharyngeal** tonsil is not well understood, but it contains a rich supply of **lymphocytes** and is covered with ciliated epithelium that traps and destroys invading pathogens that enter during inhalation. The pharyngeal tonsils are large in children, but tend to regress with age and may even disappear. The **uvula** and **soft palate** move like a pendulum during swallowing, swinging upward to close off the nasopharynx to prevent ingested materials from entering the nasal cavity. Auditory (Eustachian) tubes that connect to each middle ear cavity open into the nasopharynx. This connection is why colds often lead to ear infections.

The **oropharynx** is bordered superiorly by the **nasopharynx** and anteriorly by the oral cavity. The **oropharynx** contains two distinct sets of tonsils:

- The palatine tonsils.
 - A palatine tonsil is one of a pair of structures located laterally in the oropharynx in the area of the **fauces**.
- The lingual tonsils.
 - The **lingual** tonsil is located at the base of the tongue.

Similar to the pharyngeal tonsil, the palatine and **lingual** tonsils are composed of lymphoid tissue, and trap and destroy pathogens entering the body through the oral or nasal cavities.

The **laryngopharynx** is **inferior** to the oropharynx and **posterior** to the larynx. It continues the route for ingested

material and air until its **inferior** end, where the digestive and respiratory systems diverge. The stratified squamous epithelium of the oropharynx is continuous with the laryngopharynx. **Anteriorly**, the laryngopharynx opens into the larynx, whereas **posteriorly**, it enters the esophagus.

Larynx

The structure of the **larynx** is formed by several pieces of cartilage. Three large cartilage pieces form the major structure of the **larynx**.

- Thyroid cartilage (anterior):
 - The thyroid cartilage is the largest piece of cartilage that makes up the larynx. The thyroid cartilage consists of the **laryngeal** prominence, or “Adam’s apple,” which tends to be more prominent in males.
- Epiglottis (superior):
 - Three smaller, paired cartilages—the arytenoids, corniculates, and cuneiforms—attach to the **epiglottis** and the vocal cords and muscle that help move the vocal cords to produce speech.
- Cricoid cartilage (inferior):
 - The thick cricoid cartilage forms a ring, with a wide posterior region and a thinner anterior region.

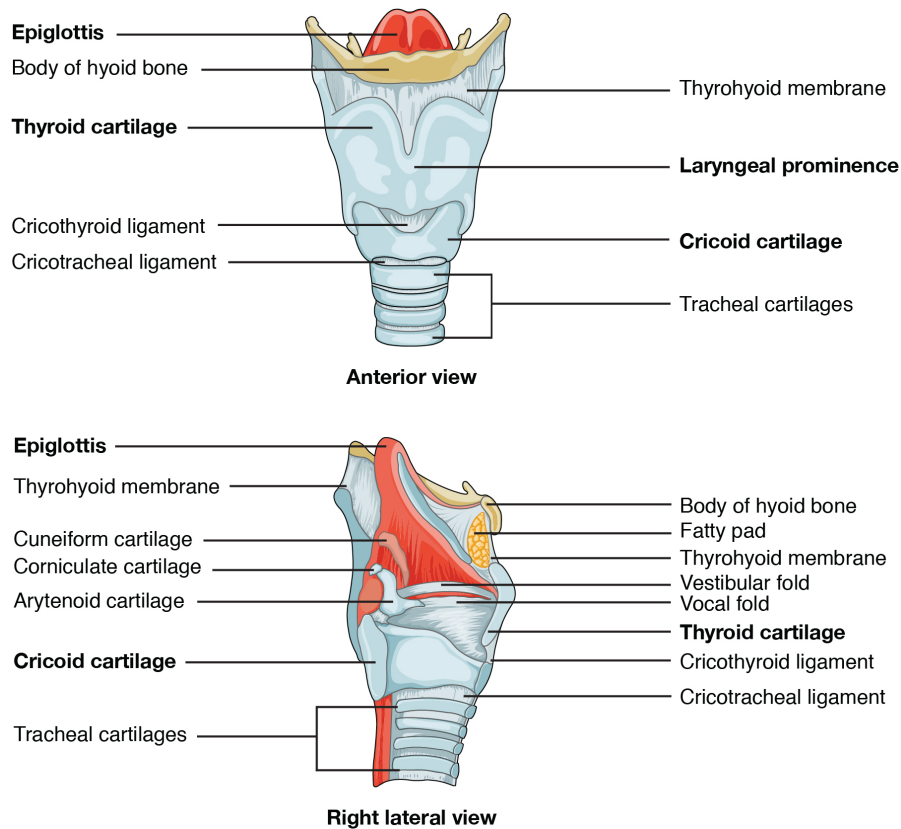


Figure 4.5 Larynx. The larynx extends from the laryngopharynx and the hyoid bone to the trachea. From Betts, et al., 2013. Licensed under CC BY 4.0. [Fig. 4.5 Image description.]

Did You Know 2?

Folds of the true vocal cords differ between individuals, resulting in voices with different pitches.

When the **epiglottis** is in the “closed” position, the unattached end of the epiglottis rests on the **glottis**. A vestibular fold, or false vocal cord, is one of a pair of folded sections of mucous membrane. A true vocal cord is one of the white, membranous folds attached by muscle to the thyroid and arytenoid cartilages of the larynx on their outer edges. The inner edges of the true vocal cords are free, allowing oscillation to produce sound.

The act of swallowing causes the pharynx and larynx to lift upward, allowing the pharynx to expand and the epiglottis of the larynx to swing downward, closing the opening to the trachea. These movements produce a larger area for food to pass through, while preventing food and beverages from entering the trachea.

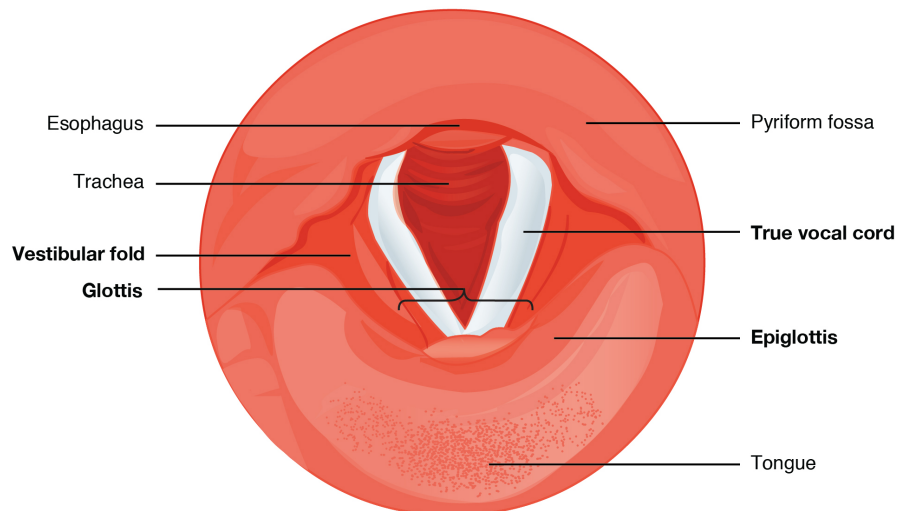


Figure 4.6 Vocal Cords. The true vocal cords and vestibular folds of the larynx are viewed inferiorly from the laryngopharynx. From Betts, et al., 2013. Licensed under CC BY 4.0. [Fig. 4.6 Image description.]

Similar to the nasal cavity and nasopharynx, this specialized epithelium produces mucus to trap debris and pathogens as they enter the trachea. The cilia beat the mucus upward towards the laryngopharynx, where it can be swallowed down the esophagus.

Trachea

The **trachea** is formed by 16 to 20 stacked, C-shaped pieces of hyaline cartilage that are connected by dense connective tissue. The trachealis muscle and elastic connective tissue together form the **fibroelastic membrane**. The fibroelastic membrane allows the trachea to stretch and expand slightly during inhalation and exhalation, whereas the rings of cartilage provide structural support and prevent the trachea from collapsing. The trachealis muscle can be contracted to force air through the trachea during exhalation. The trachea is lined with pseudostratified ciliated columnar epithelium, which is continuous with the larynx. The esophagus borders the trachea **posteriorly**.

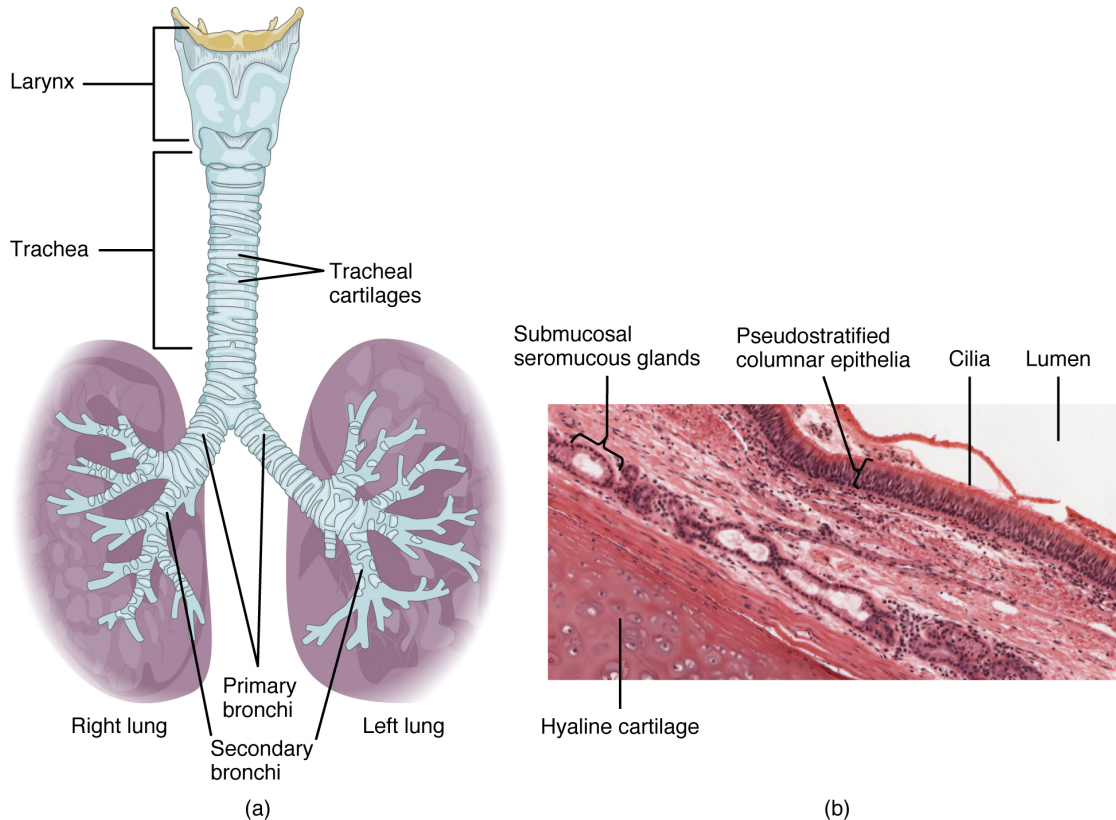


Figure 4.7 Trachea. (a) The tracheal tube is formed by stacked, C-shaped pieces of hyaline cartilage. (b) The layer visible in this cross-section of tracheal wall tissue between the hyaline cartilage and the lumen of the trachea is the mucosa, which is composed of pseudostratified ciliated columnar epithelium that contains goblet cells. LM \times 1220. (Micrograph provided by the Regents of University of Michigan Medical School \copyright 2012). From Betts, et al., 2013. Licensed under CC BY 4.0. [Fig. 4.7 Image description.]

Bronchial Tree

The trachea branches into the right and left primary bronchi at the **carina**. These bronchi are also lined by pseudostratified ciliated columnar epithelium containing mucus-producing goblet cells (Figure 4.7b). The carina is a raised structure that contains specialized nervous tissue that induces violent coughing if a foreign body, such as food, is present. Rings of cartilage, similar to those of the trachea, support the structure of the bronchi and

prevent their collapse. The primary bronchi enter the lungs at the **hilum**. The bronchi continue to branch into bronchial a tree. A bronchial tree (or respiratory tree) is the collective term used for these multiple-branched bronchi. The main function of the bronchi, like other conducting zone structures, is to provide a passageway for air to move into and out of each lung. The mucous membrane traps debris and pathogens.

A bronchiole branches from the tertiary bronchi. Bronchioles, which are about 1 mm in diameter, further branch until they become the tiny terminal bronchioles, which lead to the structures of gas exchange. There are more than 1000 terminal bronchioles in each lung. The muscular walls of the bronchioles do not contain cartilage like those of the bronchi. This muscular wall can change the size of the tubing to increase or decrease airflow through the tube.

Respiratory Zone

In contrast to the **conducting zone**, the **respiratory zone** includes structures that are directly involved in gas exchange. The respiratory zone begins where the terminal bronchioles join a respiratory bronchiole, the smallest type of bronchiole (see Figure 4.8), which then leads to an alveolar duct, opening into a cluster of alveoli.

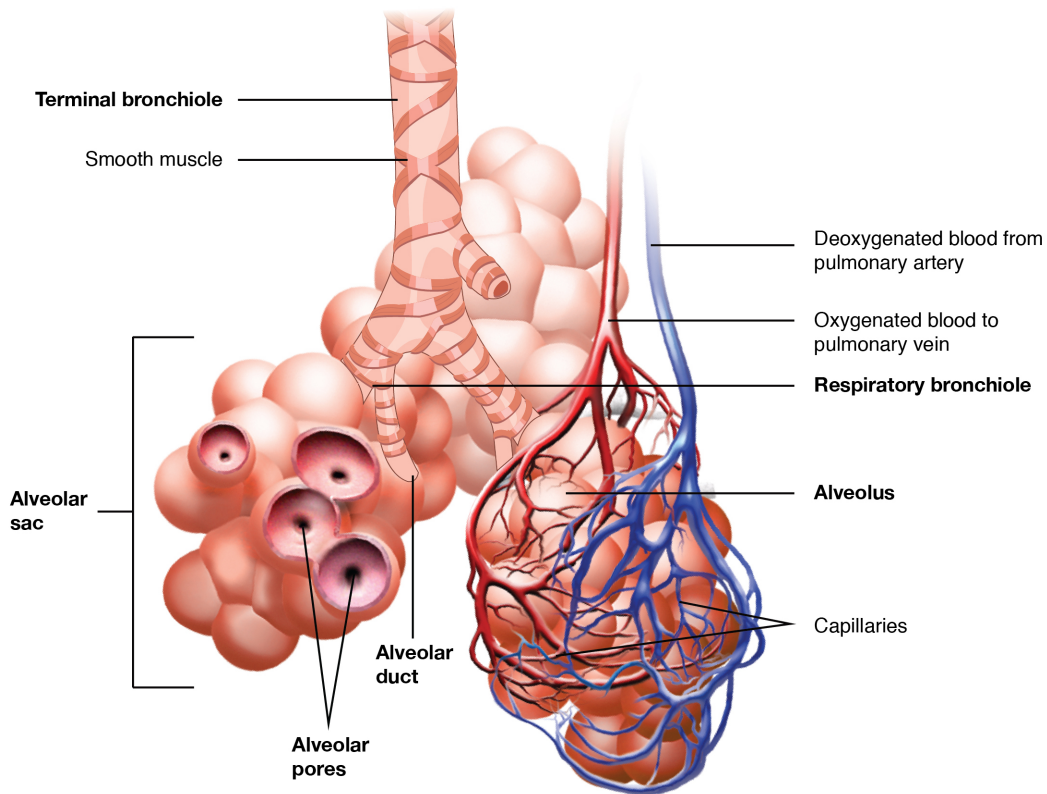


Figure 4.8 Respiratory Zone. Bronchioles lead to alveolar sacs in the respiratory zone, where gas exchange occurs. From Betts, et al., 2013. Licensed under CC BY 4.0. [Fig. 4.8 Image description.]

Alveoli

An **alveolar duct** opens into a cluster of alveoli. An alveolus is one of the many small, grape-like sacs that are attached to the alveolar ducts. An alveolar sac is a cluster of many individual alveoli that are responsible for gas exchange. An alveolus is approximately 200 μm in diameter with elastic walls that allow the alveolus to stretch during air intake, which greatly increases the surface area available for gas exchange. Alveoli are connected to their neighbors by alveolar pores, which help maintain equal air pressure throughout the alveoli and lung (see Figure 4.9).

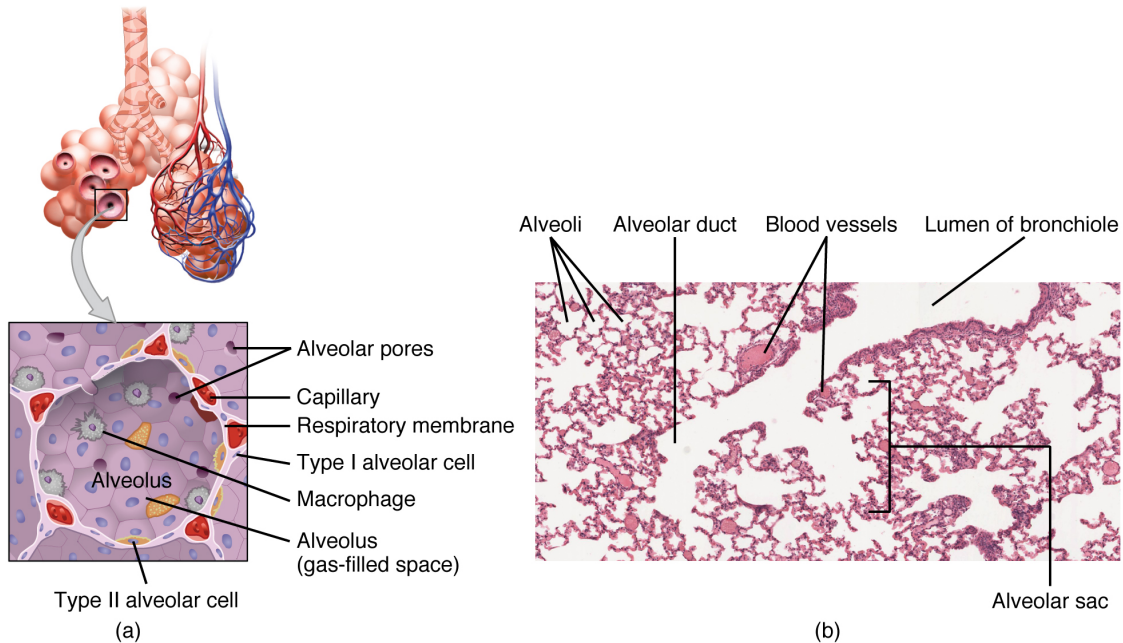


Figure 4.9 Structures of the Respiratory Zone. (a) The alveolus is responsible for gas exchange. (b) A micrograph shows the alveolar structures within lung tissue. LM \times 178. (Micrograph provided by the Regents of University of Michigan Medical School \copyright 2012). From Betts, et al., 2013. Licensed under CC BY 4.0. [Fig. 4.9 Image description.]

Concept Check

- What are the components of the **bronchial** tree?
- What is the purpose of **cilia**?
- Where does **gas** exchange take place?

Gross Anatomy of the Lungs

The lungs are pyramid-shaped, paired organs that are connected to the trachea by the right and left bronchi; on the inferior surface, the lungs are bordered by the **diaphragm**. The lungs are enclosed by the pleurae, which are attached to the mediastinum. The right lung is shorter and wider than the left lung, and the left lung occupies a smaller volume than the right. The **cardiac notch** allows space for the heart (see Figure 4.10). The apex of the lung is the superior region, whereas the base is the opposite region near the diaphragm. The costal surface of the lung borders the ribs. The mediastinal surface faces the midline.

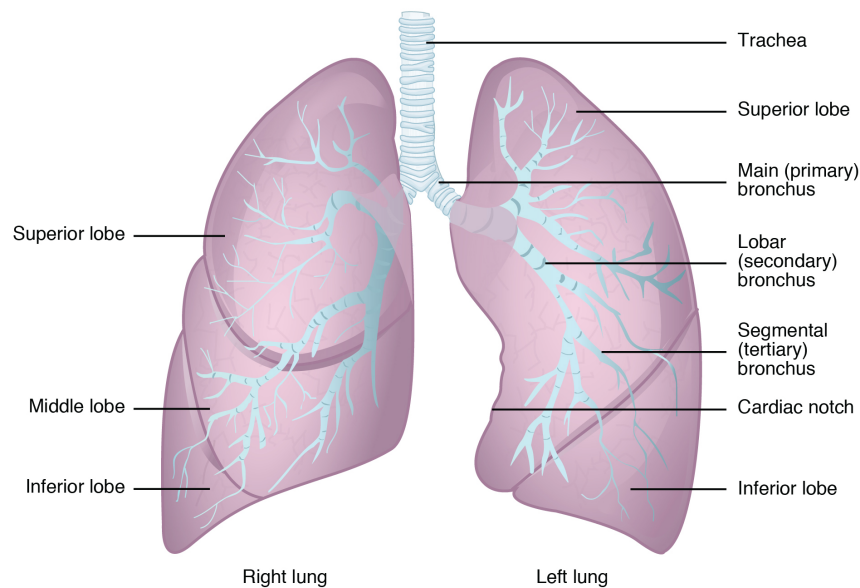


Figure 4.10 Gross Anatomy of the Lungs. From Betts, et al., 2013. Licensed under CC BY 4.0. [Fig. 4.10 Image description.]

Each lung is composed of smaller units called lobes. Fissures separate these lobes from each other. The right lung consists of three lobes: the superior, middle, and inferior lobes. The left lung consists of two lobes: the superior and inferior lobes. A pulmonary lobule is a subdivision formed as the bronchi branch into bronchioles. Each lobule receives its own large bronchiole that has multiple branches. An interlobular septum is a wall, composed of connective tissue, which separates lobules from one another.

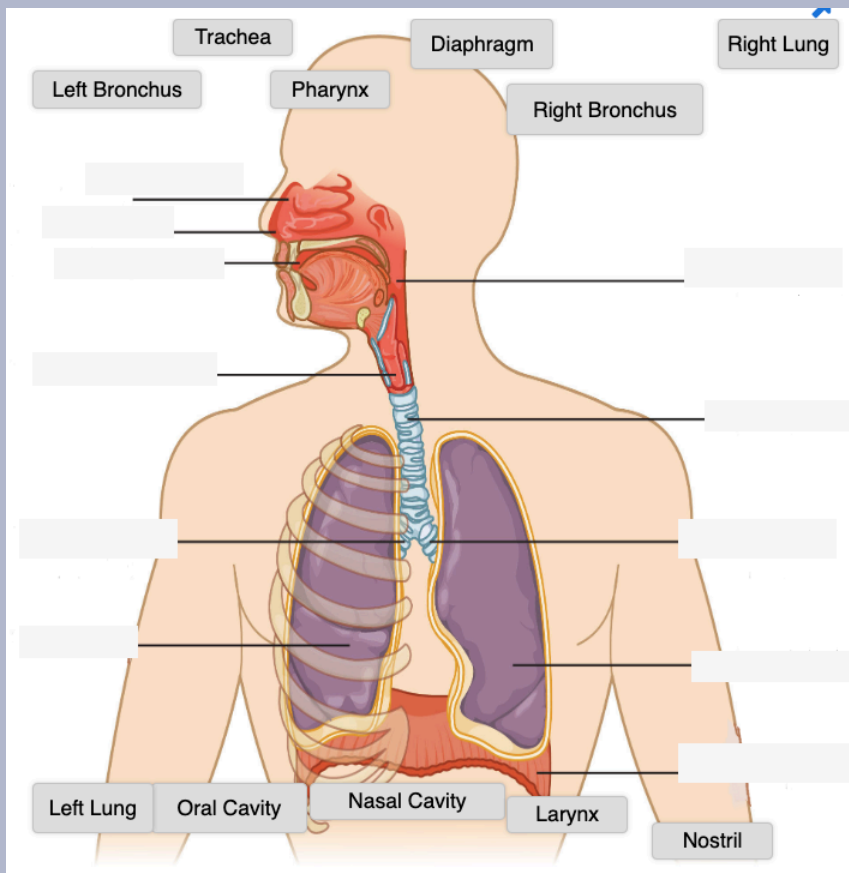
Labeling the Respiratory System

Can you correctly label the respiratory system structures?

Labeling the Respiratory System (Text Version)

Label the diagram with correct words listed below:

- | | | |
|------------------|-------------------|-----------------|
| 1. Left Bronchus | 5. Right Bronchus | 9. Nasal Cavity |
| 2. Trachea | 6. Right Lung | 10. Larynx |
| 3. Pharynx | 7. Left Lung | 11. Nostril |
| 4. Diaphragm | 8. Oral Cavity | |



Labeling the Respiratory System Diagram (Text version)

This is an anatomical diagram of the major organs and structure of the human respiratory system. Identified starting from the top of the diagram is the organs and structures which serve as a passageway for air and include, _____[Blank 1] which warms and moistens the air, the _____[Blank 2] where air enters the respiratory system and travels to the _____[Blank 3] also known as the mouth, from

the mouth the air moves to the _____[Blank 4], then to through the voice box correctly called the _____[Blank 5], and passes into the _____[Blank 6] often referred to as the windpipe. The trachea bifurcates meaning it separates into two anatomical branches each leading to each lung, on the right side is the _____[Blank 7], on the left side, the _____[Blank 8]. Air arrives at the lungs to allow for the exchange of gases arrives and enters on the right side into the _____[Blank 9] and on the left side the _____[Blank 10]. The muscular partition supporting the lungs known as the _____[Blank 11]. This detailed illustration supports understanding of the respiratory system's structure and function.

Check your answers: ¹

Activity source: Respiratory System Anatomy by Kimberlee Carter, illustration from *Anatomy and Physiology (OpenStax)*, licensed under CC BY 4.0./ Text version added.

Image Descriptions

Figure 4.2 image description: This figure shows a cross section view of the nose and throat. The major parts are labeled. [Return to Figure 4.2].

Figure 4.3 image description: This figure shows a micrograph of pseudostratified epithelium. [Return to Figure 4.3].

Figure 4.4 image description: This figure shows the side view of the face. The different parts of the pharynx are color-coded and labeled (from the top): nasal cavity, hard palate, soft palate, tongue, epiglottis, larynx, esophagus, trachea. [Return to Figure 4.4].

Figure 4.5 image description: The top panel of this figure shows the anterior view of the larynx, and the bottom panel shows the right lateral view of the larynx. [Return to Figure 4.5].

Figure 4.6 image description: This diagram shows the cross section of the larynx. The different types of cartilages are labeled (clockwise from top): pyriform fossa, true vocal cord, epiglottis, tongue, glottis, vestibular fold, trachea, esophagus. [Return to Figure 4.6].

Figure 4.7 image description: The top panel of this figure shows the trachea and its organs. The major parts including the larynx, trachea, bronchi, and lungs are labeled. [Return to Figure 4.7].

Figure 4.8 image description: This image shows the bronchioles and alveolar sacs in the lungs and depicts the exchange of oxygenated and deoxygenated blood in the pulmonary blood vessels. [Return to Figure 4.8].

Figure 4.9 image description: This figure shows the detailed structure of the alveolus. The top panel shows the alveolar sacs and the bronchioles. The middle panel shows a magnified view of the alveolus, and the bottom panel shows a micrograph of the cross section of a bronchiole. [Return to Figure 4.9].

Figure 4.10 image description: Diagram of the lungs with the major parts labelled (from top, clockwise): trachea,

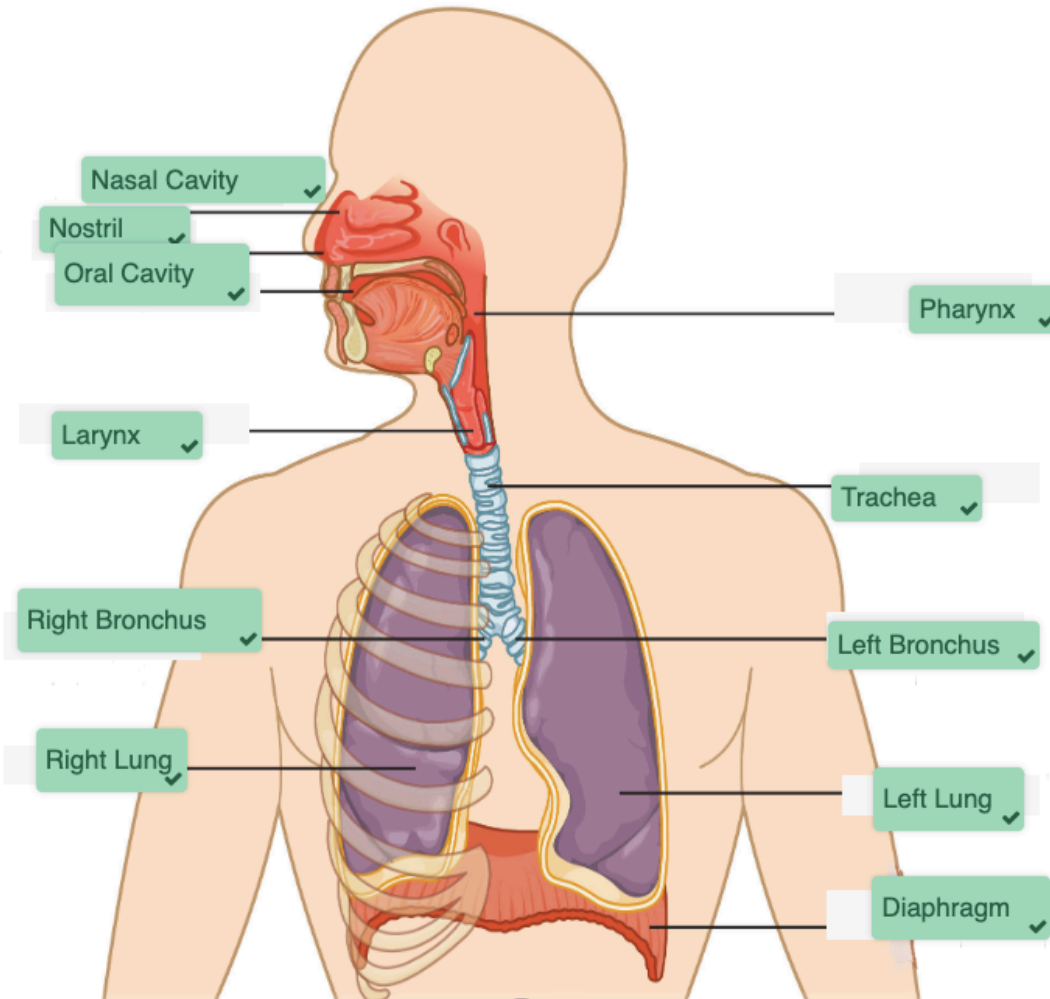
superior lobe, main bronchus, lobar bronchus, segmental bronchus, inferior lobe, inferior lobe, middle lobe, superior lobe of the left lung. [Return to Figure 4.10].

Attribution

Except where otherwise noted, this chapter is adapted from “Respiratory System (<https://ecampusontario.pressbooks.pub/medicalterminology/chapter/respiratory-system/>)” In *Building a Medical Terminology Foundation* by Kimberlee Carter and Marie Rutherford licensed under CC BY 4.0. / A derivative of Betts et al., which can be accessed for free from *Anatomy and Physiology (OpenStax)* (<https://openstax.org/books/anatomy-and-physiology/pages/1-introduction>). Adaptations: dividing Respiratory System chapter content into sub-chapters.

Notes

Respiratory System Anatomy



1.

Check

your answers: Labeling the Respiratory System Diagram This is an anatomical diagram of the major organs and structure of the human respiratory system. Identified starting from the top of the diagram is the organs and structures which serve as a passageway for air and include, **nasal cavity** which warms and moistens the air, the **nostril** where air enters the respiratory system and travels to the **oral cavity** also know as the mouth, from the mouth the air moves to the **pharynx**, then to through the voice box correctly called the **larynx**, and passes into the **trachea** often referred to as the windpipe. The trachea bifurcates meaning it separates into two anatomical branches each leading to each lung, on the right side is the **right main bronchus** branch, on the left side, the **left main bronchus**. Air arrives at the lungs to allow for the exchange of gases arrives and enters on the right side into the **right lung** and on the left side the **left lung**. The muscular partition supporting the lungs known as the **diaphragm**. This detailed illustration supports understanding of the respiratory system's structure and function.

4.3 - Physiology (Function) of the Respiratory System

Blood Supply

The major function of the lungs is to perform gas exchange, which requires blood from the pulmonary circulation.

- This blood supply contains deoxygenated blood and travels to the lungs where **erythrocytes** pick up oxygen to be transported to tissues throughout the body.
- The **pulmonary artery** carries deoxygenated, arterial blood to the alveoli.
- The pulmonary artery branches multiple times as it follows the bronchi and each branch becomes progressively smaller in diameter.
- One arteriole and an accompanying venule supply and drain one pulmonary lobule. As they near the alveoli, the pulmonary arteries become the pulmonary capillary network.
- The pulmonary capillary network consists of tiny vessels with very thin walls that lack smooth muscle fibres.
- The capillaries branch and follow the bronchioles and structure of the alveoli. It is at this point that the capillary wall meets the alveolar wall, creating the respiratory membrane.
- Once the blood is oxygenated, it drains from the alveoli by way of multiple pulmonary veins, which exit the lungs through the **hilum**.

Nervous Innervation

The blood supply of the lungs plays an important role in gas exchange and serves as a transport system for gases throughout the body. Innervation by both the **parasympathetic** and **sympathetic** nervous systems provides an important level of control through dilation and constriction of the airway.

- The parasympathetic system causes bronchoconstriction.
- The sympathetic nervous system stimulates bronchodilation.

Reflexes such as coughing, and the ability of the lungs to regulate oxygen and carbon dioxide levels, also result from **autonomic** nervous system control. Sensory nerve fibres arise from the vagus nerve, and from the second to fifth thoracic ganglia. The pulmonary plexus is a region on the lung root formed by the entrance of the nerves at the hilum. The nerves then follow the bronchi in the lungs and branch to innervate muscle fibres, glands, and blood vessels.

Pleura of the Lungs

Each lung is enclosed within a cavity that is surrounded by the pleura. The pleura (plural = pleurae) is a serous membrane that surrounds the lung. The right and left pleurae, which enclose the right and left lungs, respectively, are separated by the mediastinum.

The pleurae consist of two layers:

1. The **visceral pleura** is the layer that is superficial to the lungs, and extends into and lines the lung fissures (see Figure 4.11).
2. The **parietal pleura** is the outer layer that connects to the thoracic wall, the mediastinum, and the diaphragm.

The visceral and parietal pleurae connect to each other at the **hilum**. The pleural cavity is the space between the visceral and parietal layers.

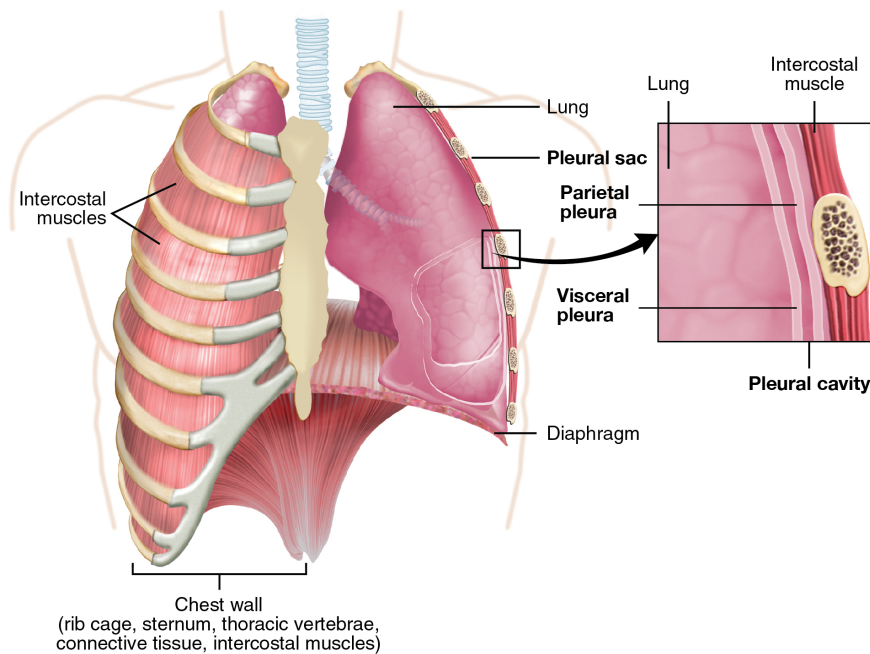


Figure 4.11 Parietal and Visceral Pleurae of the Lungs. From Betts, et al., 2013. Licensed under CC BY 4.0. [Fig. 4.11 Image description.]

The pleurae perform two major functions:

1. **Produce pleural fluid** that lubricates surfaces, reduces friction to prevent trauma during breathing, and creates surface tension that helps maintain the position of the lungs against the thoracic wall. This adhesive characteristic of the pleural fluid causes the lungs to enlarge when the thoracic wall expands during ventilation, allowing the lungs to fill with air.
2. The pleurae also **create a division** between major organs that prevents interference due to the movement of the organs, while preventing the spread of infection.

Pulmonary Ventilation

The difference in pressures drives pulmonary ventilation because air flows down a pressure gradient, that is, air flows from an area of higher pressure to an area of lower pressure.

- Air flows into the lungs largely due to a difference in pressure; atmospheric pressure is greater than intra-alveolar pressure, and intra-alveolar pressure is greater than intrapleural pressure.
- Air flows out of the lungs during expiration based on the same principle; pressure within the lungs becomes greater than the atmospheric pressure.

Pulmonary ventilation comprises two major steps: **inspiration** and **expiration** (Figure 4.12). A respiratory cycle is one sequence of inspiration and expiration.

Two muscle groups are used during **normal inspiration**, the diaphragm and the external intercostal muscles. Additional muscles can be used if a bigger breath is required.

- The diaphragm contracts, it moves inferiorly toward the abdominal cavity, creating a larger thoracic cavity and more space for the lungs.
- The external intercostal muscles contract and moves the ribs upward and outward, causing the rib cage to expand, which increases the volume of the thoracic cavity.

Due to the adhesive force of the pleural fluid, the expansion of the thoracic cavity forces the lungs to stretch and expand as well. This increase in volume leads to a decrease in intra-alveolar pressure, creating a pressure lower than atmospheric pressure. As a result, a pressure gradient is created that drives air into the lungs.

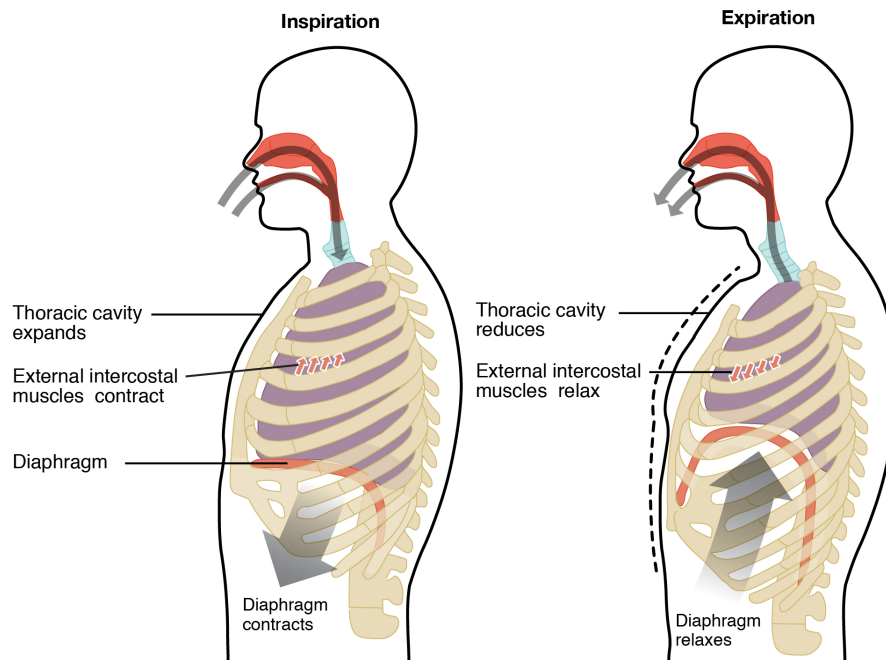


Figure 4.12 Inspiration and Expiration. Inspiration and expiration occur due to the expansion and contraction of the thoracic cavity, respectively. From Betts, et al., 2013. Licensed under CC BY 4.0. [Fig. 4.12 Image description.]

The process of **normal expiration** is passive, meaning that energy is not required to push air out of the lungs.

- The elasticity of the lung tissue causes the lung to recoil, as the diaphragm and intercostal muscles relax following inspiration.
- The thoracic cavity and lungs decrease in volume, causing an increase in interpulmonary pressure. The interpulmonary pressure rises above atmospheric pressure, creating a pressure gradient that causes air to leave the lungs.

There are different types, or modes, of breathing that require a slightly different process to allow inspiration and expiration:

- **Quiet breathing**, also known as **eupnea**, is a mode of breathing that occurs at rest and does not require the cognitive thought of the individual. During quiet breathing, the diaphragm and external intercostals must contract.
- **Diaphragmatic breathing**, also known as deep breathing, requires the diaphragm to contract. As the diaphragm relaxes, air passively leaves the lungs.
- **Costal breathing**, also known as a shallow breath, requires contraction of the intercostal muscles. As the intercostal muscles relax, air passively leaves the lungs.
- **Forced breathing**, also known as **hyperpnea**, is a mode of breathing that can occur during exercise or actions that require the active manipulation of breathing, such as singing.
 - During forced breathing, inspiration and expiration both occur due to muscle contractions. In addition to the contraction of the diaphragm and intercostal muscles, other accessory muscles must also contract.
 - During **forced inspiration**, muscles of the neck contract and lift the thoracic wall, increasing lung volume.
 - During **forced expiration**, accessory muscles of the abdomen contract, forcing abdominal organs upward against the diaphragm. This helps to push the diaphragm further into the thorax, pushing more air out. In addition, accessory muscles help to compress the rib cage, which also reduces the volume of the thoracic cavity.

Concept Check

- Breathing normally, place your hand on your stomach take in one full **respiratory** cycle.
 - What type of breathing are you doing?
- Keeping your hand on your stomach, take in one large breath and exhale.
 - What type of breathing are you doing?

- Complete 10 jumping jacks, once completed, place your hand on your stomach and take in one full respiratory cycle.
 - What type of breathing are you doing?

Respiratory Rate and Control of Ventilation

Breathing usually occurs without thought, although at times you can consciously control it, such as when you swim under water, sing a song, or blow bubbles. The respiratory rate is the total number of breaths that occur each minute. Respiratory rate can be an important indicator of disease, as the rate may increase or decrease during an illness or in a disease condition. The respiratory rate is controlled by the respiratory center located within the medulla oblongata in the brain, which responds primarily to changes in carbon dioxide, oxygen, and pH levels in the blood.

The normal respiratory rate of a child decreases from birth to adolescence:

- A child under 1 year of age has a normal respiratory rate between 30 and 60 breaths per minute.
- By the time a child is about 10 years old, the normal rate is closer to 18 to 30.
- By adolescence, the normal respiratory rate is similar to that of adults, 12 to 18 breaths per minute.

Did You Know?

Respiratory rate is the total number of breaths that occur each minute.

Watch Respiratory System, Part 2: Crash Course Anatomy & Physiology #32 (10:30 min) on YouTube (<https://youtu.be/Cqt4LjHnMEA>)

Respiratory System Words Not Easily Broken Down

Respiratory System Word Not Easily Broken Down (Text version)

1. **Epistaxis**

- nosebleed (rhinorrhagia)

2. **influenza (flu)**

- highly contagious viral infection effecting the respiratory tract

3. **pleural effusion**

- fluid in the pleural space
(caused by disease or trauma)

4. **pulmonary edema**

- fluid accumulation in alveoli and bronchioles
(related to heart failure)

5. **pulmonary embolism (PE)**

- blockage of pulmonary circulation to the lungs

6. **upper respiratory infection**

- infection of the nasal cavity, sinuses, pharynx and larynx

7. **stethoscope**

- instrument used to hear internal body sounds

8. **asphyxia**

- deprivation of oxygen to tissues, suffocation

9. **aspirate**

- suction of fluid, inhalation of fluid

10. **mucus**

- slimy liquid secreted by mucous membranes

11. **nebulizer**

- device that creates a mist for giving respiratory treatment or medication

12. **nosocomial infection**

- infection acquired in hospital

13. **sputum**

- mucous secretion from lungs, bronchi, and trachea that is expelled through the mouth

14. **ventilator**

- mechanical device that assist with breathing

Activity Source: Respiratory System Word Not Easily Broken Down by Kimberlee Carter, licensed under CC BY 4.0./ Text version added.

Common Respiratory Abbreviations

Learn more about common respiratory abbreviations below.

Common Respiratory Abbreviations

- **ABGs** (arterial blood gases)
- **AFB** (acid-fast bacilli)
- **ARDS** (acute respiratory distress syndrome)
- **C&S** (culture and sensitivity)
- **CAP** (community-acquired pneumonia)
- **CF** (cystic fibrosis)
- **CO₂** (carbon dioxide)
- **COPD** (chronic obstructive pulmonary disease)
- **CPAP** (continuous positive airway pressure)
- **CT** (computed tomography, computerized tomography)
- **CXR** (chest x-ray)
- **flu** (influenza)
- **IPF** (idiopathic pulmonary fibrosis)
- **LLL** (left lower lobe)

- **LTB** (laryngotracheobronchitis)
- **LUL** (left upper lobe)
- **O₂** (oxygen)
- **OSA** (obstructive sleep apnea)
- **PE** (pulmonary embolism)
- **PFM** (peak flow meter)
- **PFTs** (pulmonary function tests)
- **RLL** (right lower lobe)
- **RML** (right middle lobe)
- **RUL** (right upper lobe)
- **SOB** (shortness of breath)
- **TB** (tuberculosis)
- **URI** (upper respiratory infection)
- **BiPAP** (bilevel positive airway pressure)
- **CPT** (chest physiotherapy)
- **DPI** (dry powder inhaler)
- **IPPB** (intermittent positive-pressure breathing)
- **MDI** (metered-dose inhaler)
- **NIPPV** (non-invasive positive-pressure ventilator)
- **PEP** (positive expiratory pressure)
- **SVN** (small-volume nebulizer)
- **VAP** (ventilator-associated pneumonia)

Activity source: Respiratory System Abbreviations by Kimberlee Carter, licensed under CC BY 4.0./
Converted to text.

Image Descriptions

Figure 4.11 image description: This figure shows the lungs and the chest wall, which protects the lungs, in the left panel. In the right panel, a magnified image shows the pleural cavity and a pleural sac. [Return to Figure 4.11].

Figure 4.12 image description: The left panel of this image shows a person inhaling air and the location of the thoracic muscles. The right panel shows the person exhaling air and the contraction of the thoracic cavity. [Return to Figure 4.12].

Attribution

Except where otherwise noted, this chapter is adapted from “Respiratory System” in *Building a Medical Terminology Foundation* by Kimberlee Carter and Marie Rutherford licensed under CC BY 4.0. / A derivative of Betts et al., which can be accessed for free from *Anatomy and Physiology (OpenStax)* (<https://openstax.org/>)

books/anatomy-and-physiology/pages/1-introduction). Adaptations: dividing Respiratory System chapter content into sub-chapters.

4.4 - Respiratory Diseases, Disorders and Diagnostic Testing

A variety of diseases can affect the respiratory system, such as asthma, emphysema, chronic obstruction pulmonary disorder (COPD), and lung cancer. All of these conditions affect the gas exchange process and result in labored breathing and other difficulties (Betts, et al., 2013).

The Effects of Second-Hand Tobacco Smoke

The burning of a tobacco cigarette creates multiple chemical compounds that are released through mainstream smoke, which is inhaled by the smoker, and through sidestream smoke, which is the smoke that is given off by the burning cigarette. **Second-hand smoke**, which is a combination of sidestream smoke and the mainstream smoke that is exhaled by the smoker, has been demonstrated by numerous scientific studies to cause disease. At least **40 chemicals in sidestream smoke** have been identified that negatively impact human health, leading to the development of cancer or other conditions, such as immune system dysfunction, liver toxicity, cardiac **arrhythmias**, pulmonary **edema**, and neurological dysfunction. Tobacco and second-hand smoke are considered to be **carcinogenic**. Exposure to second-hand smoke can cause lung cancer in individuals who are not tobacco users themselves.

- It is estimated that the risk of developing lung cancer is increased by up to **30 percent in nonsmokers** who live with an individual who smokes in the house, as compared to nonsmokers who are not regularly exposed to second-hand smoke.
- **Children who live with an individual who smokes** inside the home have a larger number of lower respiratory infections, which are associated with hospitalizations, and a higher risk of sudden infant death syndrome (SIDS). Second-hand smoke in the home has also been linked to a greater number of ear infections in children, as well as worsening symptoms of asthma (Betts et al., 2013).

Chronic Obstructive Pulmonary Disease (COPD)

COPD is a term used to represent a number of respiratory diseases including chronic bronchitis and emphysema. COPD is a **chronic** condition with most symptoms appearing in people in their mid 50s. Symptoms include shortness of breath, cough, and sputum production. Symptoms during flare ups or times of **exacerbation** may include green or brown mucus, increase in the viscosity or amount of mucus, chest pain, fever, swollen ankles, headaches, dizziness, and blue lips or fingers. There is no cure for COPD. Shortness of breath may be controlled with **bronchodilators**. The best plan is to avoid triggers and getting sick. Clients with COPD are advised to avoid people who are sick, get the flu shot and reduce their exposure to pollution and cigarette smoke. While there are several risk factors, 80% of cases are associated with cigarette smoking (Government of Canada, 2018). To learn more about COPD visit the Public Health Agency of Canada's web page on COPD [New Tab]

(<https://www.canada.ca/en/public-health/services/chronic-diseases/chronic-respiratory-diseases/chronic-obstructive-pulmonary-disease-copd.html>).

Asthma

Asthma is a common chronic condition that affects all age groups. In 2011/2012, there were 3.8 million Canadians diagnosed with asthma and a disproportionate number of children and youth (Government of Canada, 2018). To learn more, visit the Asthma in Canada Data Blog [New Tab] (<https://health-infobase.canada.ca/datalab/asthma-blog.html>). Asthma is a chronic disease characterized by inflammation, **edema** of the airway, and bronchospasms which can inhibit air from entering the lungs. Bronchospasms can lead to an “asthma attack.” An attack may be triggered by environmental factors such as dust, pollen, pet hair, or dander, changes in the weather, mold, tobacco smoke, and respiratory infections, or by exercise and stress (Betts, et al., 2013).

Symptoms of an asthma attack involve coughing, shortness of breath, wheezing, and tightness of the chest. Symptoms of a severe asthma attack require immediate medical attention and may include **dyspnea** that results in **cyanotic** lips or face, confusion, drowsiness, a rapid pulse, sweating, and severe anxiety. The severity of the condition, frequency of attacks, and identified triggers influence the type of medication that an individual may require. Longer-term treatments are used for those with more severe asthma. Short-term, fast-acting drugs that are used to treat an asthma attack are typically administered via an inhaler. For young children or individuals who have difficulty using an inhaler, asthma medications can be administered via a nebulizer (Betts, et al., 2013).

Lung Cancer

Lung cancer is a leading cause of cancer death among both males and females in Canada, with 98% occurring in adults over 50. Symptoms often appear in the late stages, with 50% being diagnosed at stage IV (Government of Canada, 2019a). Symptoms may include shortness of breath, wheezing, blood in the mucus, chronic chest infections, **dysphagia**, pleural effusion, and enlarged lymph nodes. There are two types of lung cancer: **small cell lung cancer (SCLC)**, linked to cigarette smoking, grows quickly and metastasizes; **non-small cell lung cancer (NSCLC)** is more common and grows slowly. Changes in lung cells may lead to **benign** tumours or **malignant** tumours. Cancers that start in other parts of the body may metastasize to the lungs. Risk factors include smoking, air pollution, family history of exposure to second-hand smoke, exposure to radon gas, and exposure to carcinogens (Government of Canada, 2019). Treatment will depend on the type of lung cancer and the stage at diagnosis. Treatments may include surgery, chemotherapy, targeted therapy, immunotherapy, and radiation therapy (Government of Canada, 2019).

Sleep Apnea

Sleep apnea is a **chronic** disorder that occurs in children and adults. It is characterized by the **cessation** of breathing during sleep. These episodes may last for several seconds or several minutes, and may differ in the frequency with which they are experienced. Sleep apnea leads to poor sleep. Symptoms include fatigue, evening

napping, irritability, memory problems, morning headaches, and excessive snoring. A diagnosis of sleep apnea is usually done during a sleep study, where the patient is monitored in a sleep laboratory for several nights. Treatment of sleep apnea commonly includes the use of a device called a **continuous positive airway pressure (CPAP) machine** during sleep. The CPAP machine has a mask that covers the nose, or the nose and mouth, and forces air into the airway at regular intervals. This pressurized air can help to gently force the airway to remain open, allowing more normal ventilation to occur (Betts et al., 2013).

Respiratory System Medical Terms in Use

Respiratory System History and Physical

Respiratory System History and Physical (Text Version)

Fill in the consultation report with correct words listed below:

- Exert
- Edema
- diuretic
- membranes
- HEENT
- apnea
- heart failure
- lobes
- inspiration
- allergens
- breath
- erythema
- monitor
- asthma
- edema

RESPIRATORY SYSTEM – HISTORY & PHYSICAL EXAMINATION

PATIENT NAME: Randy BURNS

AGE: 56

DOB: July 2

SEX: Male

ATTENDING PHYSICIAN: Joyce Mathers, MD, Pulmonology

HISTORY: This 56-year-old male is presenting with a 2-week history of worsening dyspnea not associated with exertion. The patient states that he does not have to _____[Blank 1] himself for his breathing to get difficult. He feels that “he cannot get his breath” sometimes even with lying in bed. He does report developing a cold and runny nose over the last 10 days, but the worsened breathing seemed to have started a few days earlier than this. He reports that the shortness of _____[Blank 2] has progressively gotten worse in the past 2-3 days. Patient does not report any leg or foot _____[Blank 3].

PAST HISTORY: The patient has a life history of asthma triggered by environmental _____[Blank 4] – grass cutting, trees budding in the spring, street dust etc. He has used a puffer when he has symptoms since he was a child. He has a history of congestive _____[Blank 5] (CHF) and sleep _____[Blank 6] for which he uses a CPAP machine nightly.

PHYSICAL EXAMINATION: GENERAL APPEARANCE: The patient appears laboring in breathing. He is

quite distressed. VITAL SIGNS: Temperature 97.1, pulse 88, blood pressure 121/86, weight 209 pounds, height 5 feet 8 inches. _____[Blank 7] : Eye exam PERRLA. Normocephalic, atraumatic. Moist mucous _____[Blank 8]. No oropharyngeal _____[Blank 9]. No signs of infection. Tongue is coated but tonsils are clear. NECK: Supple. No lymphadenopathy. No bruits. LUNGS: There is marked wheezing on _____[Blank 10] bilaterally. Some minimal evidence of consolidation in the lower _____[Blank 11] bilaterally. No rales or rubs. CARDIAC: Irregular rate and rhythm, variable S1 and S2. EXTREMITIES: Some pedal and ankle _____[Blank 12] noted in low extremities. No cyanosis or clubbing.

ASSESSMENT AND PLAN

1. Acute shortness of breath with a history of allergic _____[Blank 13]. Rule out upper respiratory infection (URI). Will order chest x-ray stat.
2. Atrial fibrillation. Patient has a controlled rate. Will administer one dose of Lovenox overnight.
3. Mild symptoms of CHF due to lower extremity edema. Will administer Aldactone to bring this under control. Will _____[Blank 14] the patient's diuretic volume.
4. Plan to admit patient overnight for observation to await stat CXR result and to monitor the effects of _____[Blank 15] and anticoagulant therapies.

Joyce Mathers, MD, Pulmonology

Note: Report samples (H5P and Pressbooks) are to encourage learners to identify correct medical terminology and do not represent the Association for Health Documentation Integrity (AHDI) formatting standards.

Check your answers: ¹

Activity source: Respiratory System History and Physical by Sheila Bellefeuille and Heather Scudder, licensed under CC BY 4.0. / Text version added.

Respiratory System Consultation Report

Respiratory System Consultation Report (Text Version)

Fill in the consultation report with correct words listed below:

- Oxygen
- pleura
- basal

- hemoptysis
- dyspnea
- thoracostomy

- q. d.
- COPD
- antibiotics

- wheezing
- atelectasis

RESPIRATORY SYSTEM – CONSULTATION REPORT

PATIENT NAME: Wayne SAUNDERS

AGE: 59

DOB: September 7

SEX: Male

DATE OF CONSULTATION: March 29

CONSULTANT: Joyce Mathers, MD, Pulmonology

REASON FOR CONSULTATION: Sudden onset dyspnea and respiratory distress.

HISTORY: This garrulous 59-year-old was seen in the ER today with a complaint of sudden onset _____[Blank 1] and some respiratory distress. Denies any nausea, vomiting, chest pain, _____[Blank 2], cough, fever or chills.

PAST HISTORY: Is positive for asthma and _____[Blank 3] as patient is a lifelong smoker at 1+ packs per day.

ASSESSMENT: CHEST has good air entry bilaterally. No _____[Blank 4]. Bilateral _____[Blank 5] crackles are noted. Some dullness to percussion on the left. CT scan was ordered and shows a left _____ [Blank 6] effusion and acute pneumothorax due to infectious process. Probable comprehensive _____[Blank 7].

MEDICATIONS

1. Adalat 30 mg _____[Blank 8].
2. Atenolol 50 mg (half dose) q.d.
3. Flonase 50 mcg one spray on each side q.d.
4. Zolof 100 mg once q.d.

PLAN

1. Admit patient to the unit for treatment and possible left _____[Blank 9] if indicated by lack of improvement on standard therapy.
2. Treat with a course of _____[Blank 10] for the URI.
3. _____[Blank 11] therapy if indicated by O2 sats.
4. Repeat CT scan in 48 hours.

Joyce Mathers, MD, Pulmonology

Note: Report samples (H5P and Pressbooks) are to encourage learners to identify correct medical

terminology and do not represent the Association for Health Documentation Integrity (AHDl) formatting standards.

Check your answers: ²

Activity source: Respiratory System Consultation Report by Sheila Bellefeuille and Heather Scudder, licensed under CC BY 4.0. / Text version added.

Respiratory System Consultation Report

Respiratory System Consultation Report (Text Version)

Fill in the consultation report with correct words listed below:

- Kidney
- respiratory
- childhood
- urinalysis
- shadowing
- mid-thoracic
- pulmonary
- hepatotoxic
- x-ray
- apex
- dyspnea
- flu shot
- myoplasmal
- rasping
- rhinorrhea
- expiration
- rales
- vaccine

RESPIRATORY SYSTEM – CONSULTATION REPORT

PATIENT NAME: Mateo DIAZ

AGE: 22

DOB: June 25

SEX: Male

DATE OF CONSULTATION: April 16

CONSULTING PHYSICIAN: Joyce Mathers, MD Pulmonology

HISTORY: This 22-year-old Hispanic gentleman is referred to me for a 2-week history of new rasping cough associated with a dull right _____[Blank 1] intercostal discomfort. He has some associated _____[Blank 2] on exertion but is otherwise well with no presenting symptoms of a cold or _____[Blank 3] infection. No fever, sputum or _____[Blank 4].

PAST HISTORY: He has a history of _____[Blank 5] asthma that seemed to disappear after he hit his

mid-20s. He has a history of extensive travel for work and leisure and most recently was on a work trip to Wuhan, China in late December. He receives a _____[Blank 6] annually and did have the most recent _____[Blank 7] in October 2019.

His physical exam is relatively unremarkable. Blood pressure is 120/83, respirations 12. Temperature normal at 37. Chest exam is CTA with no _____[Blank 8], rhonchi or wheezes. Even on a forced exhalation, we could not reproduce the _____[Blank 9] cough symptom.

ASSESSMENT: A PA and lateral chest _____[Blank 10] revealed a new infiltrate and _____[Blank 11] along the left mid-lung margin all the way to the _____[Blank 12]. Spirometry showed normal pressures on forced _____[Blank 13].

PLAN

1. Rule out _____[Blank 14] pneumonia versus other lung infection or infiltrates such as granulomatosis, aspergillosis or sarcoidosis.
2. CBC with differential, chem panel, ESR, ACE, and mycoplasma titres.
3. Repeat full function tests (PFTs) in 2 weeks.

If required, will treat with Amphotericin B, Tosufloxacin, Macrolide or similar. If any of these treatments are indicated, weekly LFTs and _____[Blank 15] function testing will be required as these classes of drugs is notoriously _____[Blank 16] and nephrotoxic.

I will see the patient again in approximately 4 days to review the results and decide on a course of action – more testing or appropriate treatments as indicated above.

Joyce Mathers, MD Pulmonology

Note: Report samples (H5P and Pressbooks) are to encourage learners to identify correct medical terminology and do not represent the Association for Health Documentation Integrity (AHDI) formatting standards.

Check your answers: ³

Activity source: Respiratory System Consultation Report by Sheila Bellefeuille and Heather Scudder, licensed under CC BY 4.0. / Text version added.

Medical Specialties and Procedures Related to the Respiratory System

Respiratory Medicine (Respirology)

Respiratory medicine is concerned with the diagnosis and treatment of diseases related to the respiratory

system. Respiratory medicine requires in-depth knowledge of internal medicine. A physician who specializes in respirology is called a respirologist. Physicians specialize with three years in either adult or pediatric respiratory medicine in addition to three-years core training in internal medicine or pediatric medicine (Canadian Medical Association, 2018). For more information, visit the Canadian Medical Association's information page on respirology [PDF] (<https://www.cma.ca/sites/default/files/2019-01/respirology-e.pdf>).

Respiratory Therapists (RTs)

Respiratory Therapists (RTs) are health care professionals that monitor, assess, and treat people who are having problems breathing. RTs are regulated, which means they must be a member of the College of Respiratory Therapists of Ontario to work as an RT in Ontario. RTs are trained in ventilation and airway management, cardiopulmonary resuscitation, oxygen and aerosol therapy. They care for patients during cardiac stress-testing, pulmonary function testing, smoking cessation, high-risk births, rehabilitation, and surgery. They treat patients with asthma, bronchitis, COPD, emphysema, heart disease, and pneumonia (College of Respiratory Therapists of Ontario, n.d.). For more information, visit the College of Respiratory Therapist's College of Respiratory Therapist's What is a Respiratory Therapist? [New Tab] (<https://www.crto.on.ca/public/what-is-respiratory-therapy/>) web page.

Thoracic Surgeon

A thoracic surgeon refers to a surgeon who has specialized in either thoracic (chest) surgery or cardiothoracic (heart and chest) surgery and cares for or performs surgery for patients with serious conditions of the thorax (London Health Sciences Centre, 2020). To learn more, visit the London Health Science Centre's Welcome to Thoracic Surgery web page [New Tab] (<https://www.lhsc.on.ca/thoracic-surgery/welcome-to-thoracic-surgery>).

Spirometry Testing

Spirometry testing is used to find out how well lungs are working by measuring air volume.

- **Respiratory volume** describes the amount of air in a given space within the lungs, or which can be moved by the lung, and is dependent on a variety of factors.
- **Tidal volume** refers to the amount of air that enters the lungs during quiet breathing, whereas inspiratory reserve volume is the amount of air that enters the lungs when a person inhales past the tidal volume.
- **Expiratory reserve volume** is the extra amount of air that can leave with forceful expiration following tidal expiration.
- **Residual volume** is the amount of air that is left in the lungs after expelling the expiratory reserve volume.
- **Respiratory capacity** is the combination of two or more volumes.
- **Anatomical dead space** refers to the air within the respiratory structures that never participates in gas exchange, because it does not reach functional alveoli.

- **Respiratory rate** is the number of breaths taken per minute, which may change during certain diseases or conditions.

Both respiratory rate and depth are controlled by the respiratory centres of the brain, which are stimulated by factors such as chemical and pH changes in the blood. These changes are sensed by central chemoreceptors, which are located in the brain, and peripheral chemoreceptors, which are located in the aortic arch and carotid arteries. A rise in carbon dioxide or a decline in oxygen levels in the blood stimulates an increase in respiratory rate and depth (Betts, et al., 2013).

Watch Spirometry (5 min) on YouTube (<https://youtu.be/y9eiVqddVV0>)

Attribution

Except where otherwise noted, this chapter is adapted from “Respiratory System (<https://ecampusontario.pressbooks.pub/medicalterminology/chapter/respiratory-system/>)” in *Building a Medical Terminology Foundation* by Kimberlee Carter and Marie Rutherford licensed under CC BY 4.0. / A derivative of Betts et al., which can be accessed for free from *Anatomy and Physiology (OpenStax)* (<https://openstax.org/books/anatomy-and-physiology/pages/1-introduction>). Adaptations: dividing Respiratory System chapter content into sub-chapters.

Notes

1. Exert, 2. Breath, 3. Edema, 4. Allergens, 5. Heart failure, 6. Apnea, 7. HEENT, 8. Membranes, 9. Erythema, 10. Inspiration, 11. Lobes, 12. Edema, 13. Asthma, 14. Monitor, 15. Diuretic
1. Dyspnea, 2. Hemoptysis, 3. COPD, 4. Wheezing, 5. Basal, 6. Pleural, 7. atelectasis, 8. q. d., 9. Thoracostomy, 10. Antibiotics, 11. Oxygen
1. Mid-thoracic, 2. Dyspnea, 3. Respiratory, 4. Rhinorrhea, 5. Childhood, 6. Flu-shot, 7. Vaccine, 8. Rales, 9. Rasping, 10. X-ray, 11. Shadowing, 12. Apex, 13. Expiration, 14. Myoplasmal, 15. Urinalysis, 16. Pulmonary, 17. Kidney, 18. Hepatotoxic.

Vocabulary & Check Your Knowledge

Respiratory System Vocabulary

Alveolar Duct

A tube composed of smooth muscle and connective tissue.

Anteriorly

Pertaining to front.

Autonomic

Unconsciously regulates.

Benign

Non-cancerous.

Bronchodilators

Substance that dilates the bronchi and bronchioles.

Carcinogenic

Causing cancer.

Cardiac Notch

The cardiac notch is an indentation on the surface of the left lung.

Carina

The carina is a ridge of cartilage that separates the two main bronchi.

Cessation

Stop or stopping.

Chronic

A condition that lasts over a long time with periods of exacerbation and periods of remission.

Conducting Zone

The major functions of the conducting zone are to provide a route for incoming and outgoing air, remove debris and pathogens from the incoming air, and warm and humidify the incoming air. Several structures within the conducting zone perform other functions as well. The epithelium of the nasal passages, for example, is essential to sensing odors, and the bronchial epithelium that lines the lungs can metabolize some airborne carcinogens.

Cyanotic

Pertaining to abnormal colour of blue (bluish colour, lips and nail beds) caused by deoxygenation.

Defensins

The lysozyme enzyme and proteins which have antibacterial properties.

Diaphragm

A flat, dome shaped muscle located at the base of the lungs and thoracic cavity.

Dyspnea

Difficulty breathing.

Epiglottis

The epiglottis, attached to the thyroid cartilage, is a very flexible piece of elastic cartilage that covers the opening of the trachea.

Erythrocytes

Red blood cells.

Eupnea

Normal breathing.

Expiration

Exhalation or the process of causing air to leave the lungs.

External nose

The external nose consists of the surface and skeletal structures that result in the outward appearance of the nose and contribute to its numerous functions.

Fauces

The fauces is the opening at the connection between the oral cavity and the oropharynx.

Fibroelastic Membrane

A fibroelastic membrane is a flexible membrane that closes the posterior surface of the trachea, connecting the C-shaped cartilages.

Glottis

The glottis is composed of the vestibular folds, the true vocal cords, and the space between these folds.

Hard Palate

The hard palate is located at the anterior region of the nasal cavity and is composed of bone.

Hilum

The hilum is a ridge of cartilage that separates the two main bronchi. A concave region where blood vessels, lymphatic vessels, and nerves also enter the lungs.

Hyperpnea

Forced breathing or breathing that is excessive.

Inferior

Pertaining to below.

Inspiration

Inhalation or process of breathing air into the lungs.

Laryngeal

Pertaining to the larynx.

Laryngopharynx

The laryngopharynx borders the oropharynx, trachea, and esophagus.

Larynx

The larynx is a cartilaginous structure inferior to the laryngopharynx that connects the pharynx to the trachea and helps regulate the volume of air that enters and leaves the lungs. Also known as the voice box.

Lingual

Pertaining to the tongue.

Lymphocytes

Lymphocytes are lymph cells, a type of white blood cell.

Malignant

Cancerous.

Nasopharynx

The nasopharynx serves as an airway and is continuous with the nasal cavity.

Oropharynx

The oropharynx is a passageway for both air and food and borders the nasopharynx and the oral cavity.

Pharyngeal

Pertaining to the pharynx.

Pharyngeal Tonsils

A pharyngeal tonsil, also called an adenoid, is an aggregate of lymphoid reticular tissue similar to a lymph node that lies at the superior portion of the nasopharynx.

Pharynx

The pharynx is a tube formed by skeletal muscle and lined by mucous membrane that is continuous with that of the nasal cavities. Also known as the throat.

Posterior

Pertaining to behind.

Pulmonary Artery

The pulmonary artery is the artery that arises from the pulmonary trunk.

Respiratory Zone

The respiratory zone includes structures that are directly involved in gas exchange.

Rhinorrhea

Excessive flow or discharge from the nasal cavity (runny nose).

Septal Cartilage

The flexible portion you can touch with your fingers.

Soft Palate

The soft palate is located at the posterior portion of the nasal cavity and consists of muscle tissue.

Sympathetic

Flight or fight response.

Trachea

The trachea (windpipe) extends from the larynx toward the lungs.

Uvula

The uvula is a small bulbous, teardrop-shaped structure located at the apex of the soft palate.

Test Yourself

Respiratory System Glossary Reinforcement Activity (Text Version)

1. A small bulbous, teardrop-shaped structure located at the apex of the soft palate is called the _____[Blank 1].
 - a. Lymphocytes
 - b. Posterior
 - c. Uvula
2. Located at the anterior region of the nasal cavity and is composed of bone is the _____[Blank 2].
 - a. Glottis
 - b. Fauces
 - c. Hard Palate
3. A ridge of cartilage that separates the two main bronchi is called the _____[Blank 3].
 - a. Carina
 - b. Eupnea
 - c. Alveolar Duct
4. _____[Blank 4] serves as an airway and is continuous with the nasal cavity.
 - a. Conducting zone
 - b. Nasopharynx
 - c. Hilum
5. _____[Blank 5] consists of the surface and skeletal structure that result in the outward appearance of the nose and contribute to its numerous functions.
 - a. Pharynx
 - b. Inferior
 - c. External nose

Check your answers: ¹

Activity source: Respiratory System Glossary Reinforcement Activity by Gisele Tuzon, licensed under CC BY 4.0./Text version added.

Attribution

Except where otherwise noted, this chapter is adapted from “Respiratory System (<https://ecampusontario.pressbooks.pub/medicalterminology/chapter/respiratory-system/>)” in *Building a Medical Terminology Foundation* by Kimberlee Carter and Marie Rutherford licensed under CC BY 4.0. / A derivative of Betts et al., which can be accessed for free from *Anatomy and Physiology (OpenStax)* (<https://openstax.org/books/anatomy-and-physiology/pages/1-introduction>). Adaptations: dividing Respiratory System chapter content into sub-chapters.

Notes

1. 1. Uvula, 2. Hard Palate, 3. Carina, 4. Nasopharynx, 5. External nose

References

Canadian Cancer Society. (2020, May). *Treatments for non-small cell lung cancer*. Cancer Information. <https://www.cancer.ca/en/cancer-information/cancer-type/lung/treatment/?region=on>

Canadian Medical Association. (2019, December). *Respirology profile*. Canadian Specialty Profiels. <https://www.cma.ca/sites/default/files/2019-01/respirology-e.pdf>

College of Respiratory Therapists of Ontario. (n.d.). *What is a respiratory therapist?*. <https://www.crto.on.ca/public/what-is-respiratory-therapy/>

CrashCourse. (2015, August 24). *Respiratory system, part 1: Crash Course anatomy & physiology #31* [Video]. YouTube. <https://youtu.be/bHZsvBdUC2I>

CrashCourse. (2015, August 31). *Respiratory system, part 2: Crash Course anatomy & physiology #32* [Video]. YouTube. <https://youtu.be/Cqt4LjHnMEA>

freshwaterl. (2009, September 11). *Spirometry* [Video]. YouTube. <https://youtu.be/y9eiVqddVVo>

Government of Canada. (2018, May 1). *Asthma in Canada*. Data Blog, Government of Canada. <https://health-infobase.canada.ca/datalab/asthma-blog.html>

Government of Canada. (2019, December 9). *Chronic Obstructive Pulmonary Disease (COPD)*. Public Health Agency of Canada. <https://www.canada.ca/en/public-health/services/chronic-diseases/chronic-respiratory-diseases/chronic-obstructive-pulmonary-disease-copd.html>

Government of Canada. (2021, March 17). *Lung cancer in Canada*. Public Health Agency of Canada. <https://www.canada.ca/en/public-health/services/publications/diseases-conditions/lung-cancer.html>

Government of Canada. (2023, August 11). *Lung cancer*. Public Health Agency of Canada. <https://www.canada.ca/en/public-health/services/chronic-diseases/cancer/lung-cancer.html>

London Health Sciences Centre. (2020). *Welcome to thoracic surgery*. <https://www.lhsc.on.ca/thoracic-surgery/welcome-to-thoracic-surgery>