

The nose is composed primarily of cartilages except at the “bridge” of the nose where the nasal bone resides. Anteriorly, the air enters or leaves the nose via the nares, which open into the nasal vestibule, whereas posteriorly the nasal cavity communicates with the nasopharynx via paired apertures called the **choanae**.

COLOR the following cartilages contributing to the nose, using a different color for each cartilage:

- 1. Lateral processes of the septal cartilage
- 2. Major alar cartilages
- 3. Septal cartilage

The nasal cavity is separated from the cranial cavity by portions of the frontal, ethmoid, and sphenoid bones, and from the oral cavity inferiorly by the **hard palate**. A nasal septum, usually deviated slightly to one side or the other, divides the nasal cavity into right and left chambers. The anterior third of the nasal septum is cartilaginous and the posterior two thirds is bony.

COLOR the following features of the nasal septum, using a different color for each feature:

- 3. Septal cartilage
- 4. Perpendicular plate of the ethmoid bone
- 5. Vomer

The lateral wall of the nasal cavity is characterized by three shelflike conchae, or turbinates (conchae covered with respiratory epithelium also are often referred to as turbinates), that protrude into the cavity, and along with their covering of nasal respiratory epithelium, they greatly increase the surface area for warming, humidifying, and filtering the air. The space beneath each shelflike concha is called a **meatus**. At the most superior aspect of the nasal cavity resides the olfactory region, with its olfactory epithelium and specialized sensory cells for the detection of smells.

COLOR the following features of the lateral wall of the nasal cavity, using a different color for each feature:

- 6. Superior concha (turbinate)
- 7. Middle concha (turbinate)
- 8. Inferior concha (turbinate)

The innervation of the nasal cavities includes:

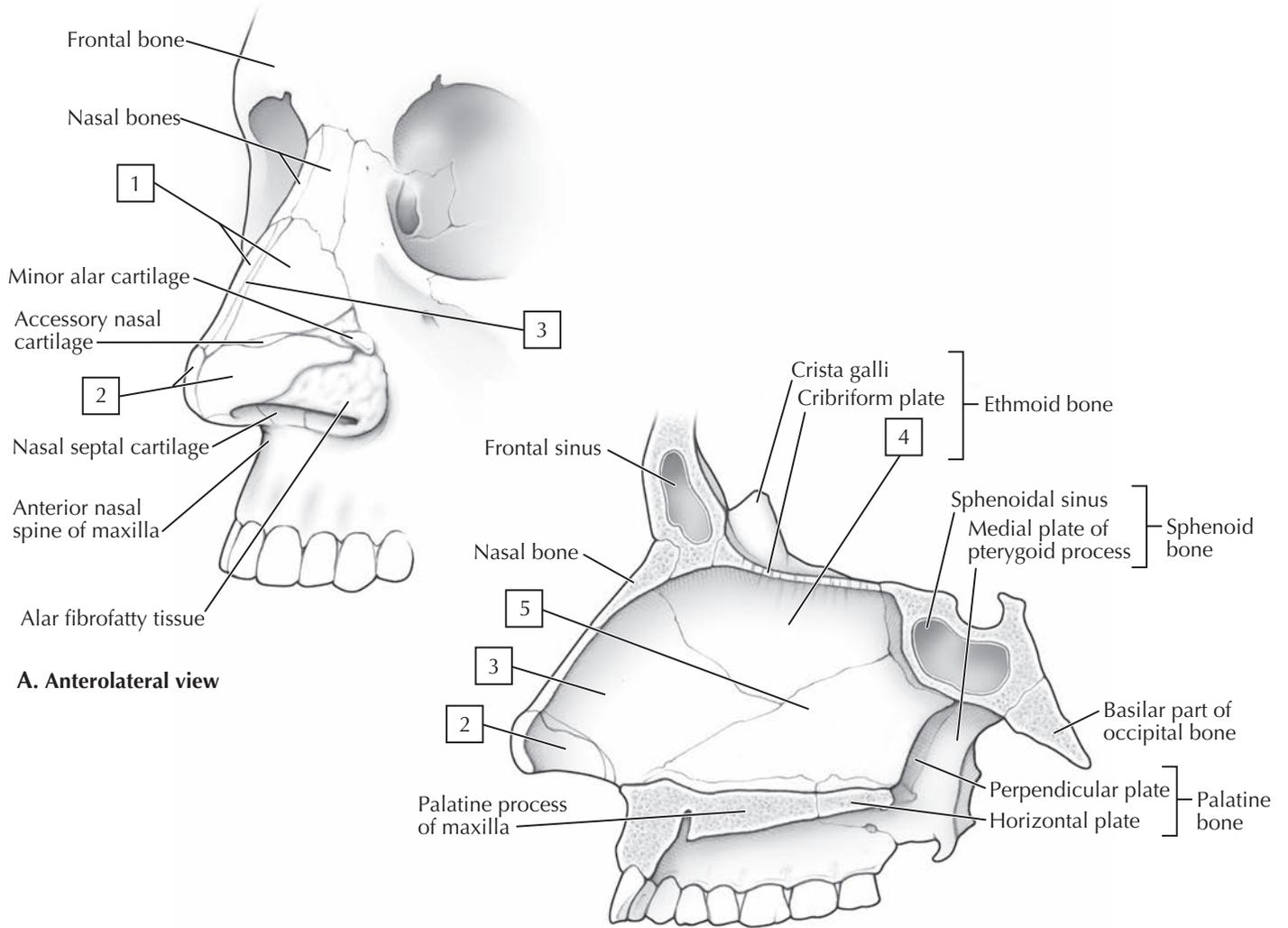
- **CN I:** olfaction (smell)
- **CN V₁ and V₂:** sensory via the maxillary division of the trigeminal, except for the anterior part of the nose (V₁)
- **CN VII:** secretomotor parasympathetic fibers course from the facial nerve to the pterygopalatine ganglion, synapse here, and then course with branches of CN V₂ to innervate the nasal mucous glands
- Postganglionic sympathetics from the superior cervical ganglion to the blood vessels

The blood supply to the nasal cavities is largely by the branches of the maxillary and facial arteries, with some contributions from the ethmoidal branches of the ophthalmic artery.

Posteriorly, the nasal cavities communicate via the choanae with the most superior portion of the pharynx, called the **nasopharynx**. In its lateral wall, the opening of the pharyngotympanic (auditory, eustachian) tube is visible and represents a direct conduit to the middle ear cavity.

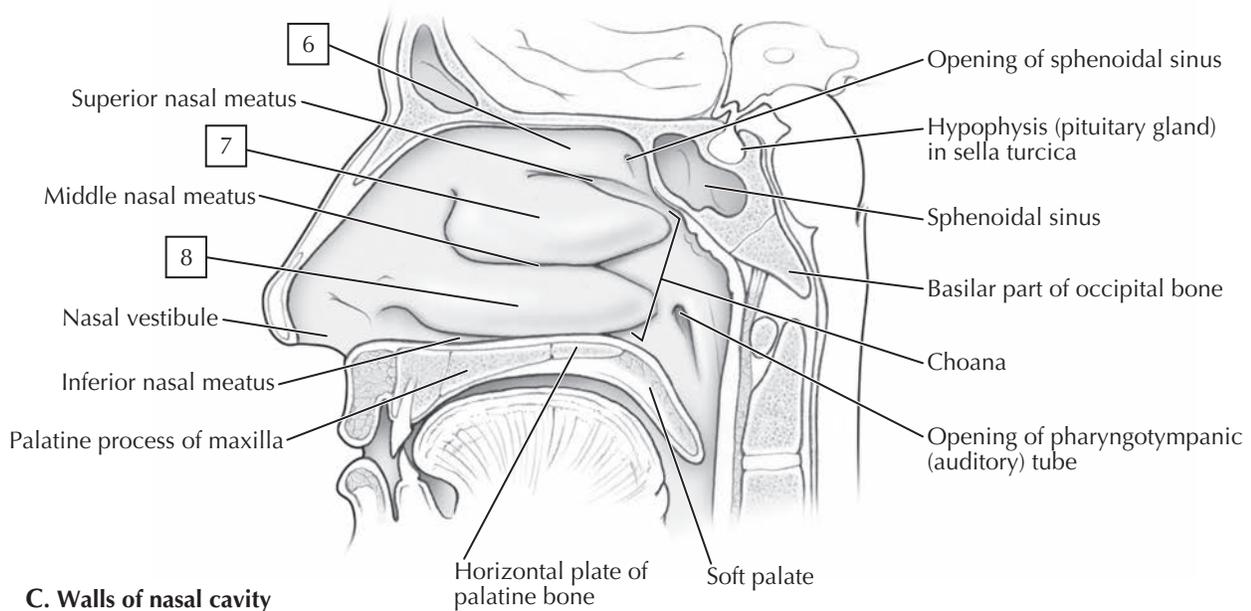
Clinical Note:

Acute otitis media, an inflammation of the middle ear, is a common disorder in children under the age of 15 years. In part this disorder is prevalent because of the horizontal nature of the pharyngotympanic, or auditory, tube in children (the tube is slightly more vertical in adults) and the fact that the normal drainage toward the nasopharynx by gravity is compromised. Infections may be bacterial or viral.



A. Anterolateral view

B. Medial wall of nasal cavity



C. Walls of nasal cavity

There are four pairs of paranasal sinuses, which are open chambers within several of the bones surrounding the nose and orbits. They are lined with respiratory epithelium, assist in warming and humidifying the inspired air, and drain their mucus secretions into the nasal cavities. Sneezing and blowing the nose clears the nasal cavity and sinuses of excess secretions. The paranasal sinuses and their features are summarized in the following table.

SINUS	DESCRIPTION
Frontal	Paired sinuses, lying anteriorly in frontal bone and draining into semilunar hiatus of middle meatus
Ethmoid	Paired anterior, middle, and posterior sinuses in ethmoid bone; anterior and middle draining into middle meatus (hiatus semilunaris and ethmoid bulla, respectively), and posterior, into superior nasal meatus
Sphenoidal	Paired sinuses, in sphenoid bone, draining into spheno-ethmoidal recess
Maxillary	Paired sinuses, in maxilla, draining into middle meatus (semilunar hiatus); largest sinus (20-30 ml)

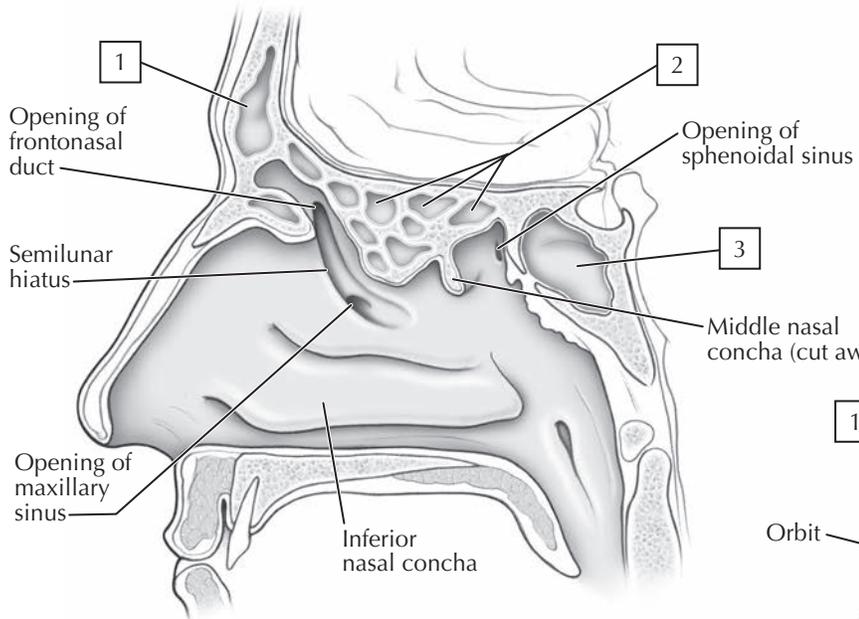
The mucosa of the paranasal sinuses is innervated by sensory branches from CN V (ophthalmic and maxillary divisions).

COLOR the following paranasal sinuses, using a different color for each sinus:

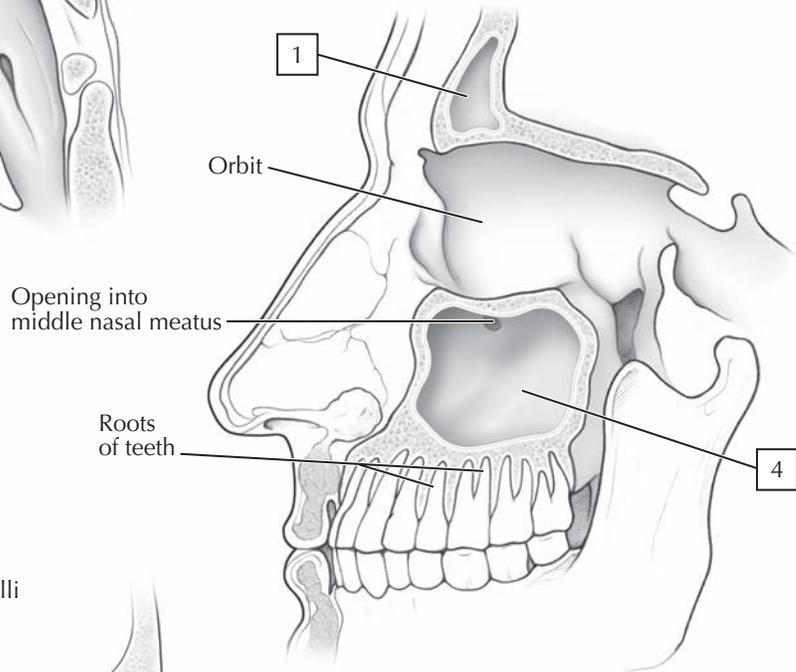
- 1. Frontal sinus
- 2. Ethmoid air cells (sinuses)
- 3. Sphenoid sinus
- 4. Maxillary sinus

Clinical Note:

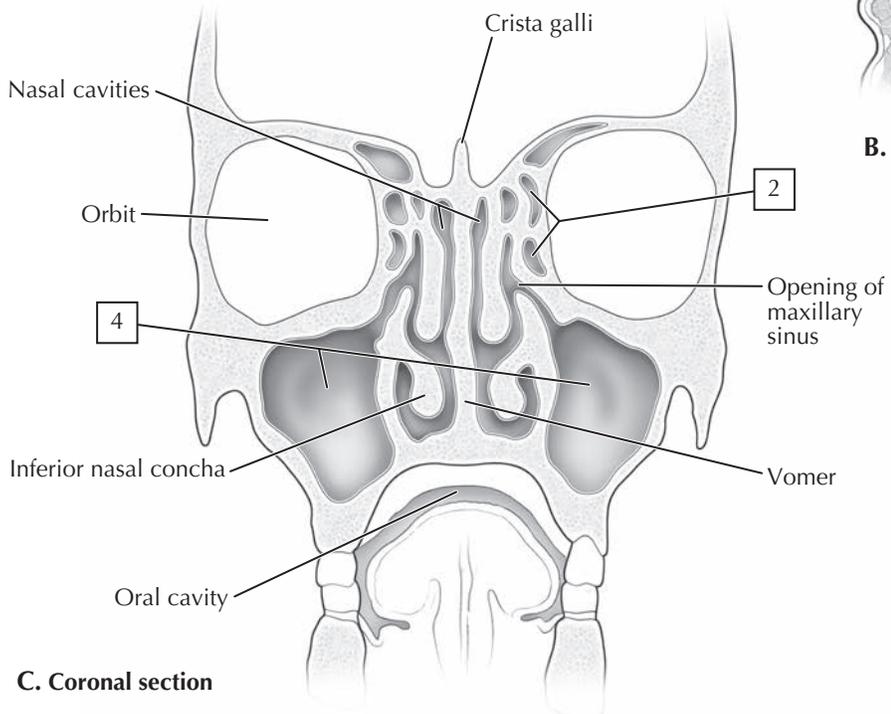
Rhinosinusitis is an inflammation of the paranasal sinuses, most commonly the ethmoid and maxillary sinuses and nasal cavity. Usually, this condition begins as a viral infection followed by a secondary bacterial infection that obstructs the discharge of normal sinus mucus secretions and compromises the sterility of the sinuses.



A. Sagittal section



B. Lateral dissection



C. Coronal section

7 Oropharynx, Laryngopharynx, and Larynx

The pharynx (throat) is subdivided into three regions:

- **Nasopharynx:** lies posterior to the nasal cavities and above the soft palate (already discussed)
- **Oropharynx:** extends from the soft palate to the superior tip of the epiglottis, and lies posterior to the oral cavity
- **Laryngopharynx:** extends from the tip of the epiglottis to the inferior aspect of the cricoid cartilage (often referred to by clinicians as the “hypopharynx”), lying posterior to the larynx

The oropharynx and laryngopharynx provide a passageway for both air and food (solid and liquids) and are essentially fibromuscular tubes lined with stratified squamous epithelium to protect the lining from abrasion. The muscular walls of the pharynx are formed largely by the three pharyngeal constrictors discussed previously (see Plate 3-5). **Waldeyer’s lymphatic ring**, composed of the tubal tonsils, nasopharyngeal tonsils, lingual tonsils, and the palatine tonsils, “guard” the openings into the pharynx and provide an important lymphatic immunologic defense mechanism, especially in children and adolescents (see Plate 6-6).

The larynx lies anterior to the laryngopharynx and proximal esophagus, at about the level of the C3-C6 vertebrae and superior to the trachea. Structurally, the larynx consists of nine cartilages joined by ligaments and membranes.

CARTILAGE	DESCRIPTION
Thyroid	Two hyaline laminae and the laryngeal prominence (Adam’s apple)
Cricoid	Signet ring-shaped hyaline cartilage just inferior to thyroid
Epiglottis	Spoon-shaped elastic cartilage plate attached to thyroid
Arytenoid	Paired pyramidal cartilages that rotate on cricoid cartilage
Corniculate	Paired cartilages that lie on apex of arytenoid cartilages
Cuneiform	Paired cartilages in ary-epiglottic folds that have no articulations

The laryngeal cavity includes the following subdivisions:

- **Vestibule:** lies between the laryngeal inlet (just posterior to the epiglottis) and the vestibular folds
- **Rima glottidis:** the space or “slit” between the vocal folds

- **Ventricle:** the recesses that extend laterally between the vestibular and vocal folds
- **Infraglottic cavity:** the space below the vocal folds to the level of the cricoid cartilage; below the cricoid cartilage the infraglottic cavity becomes the proximal trachea

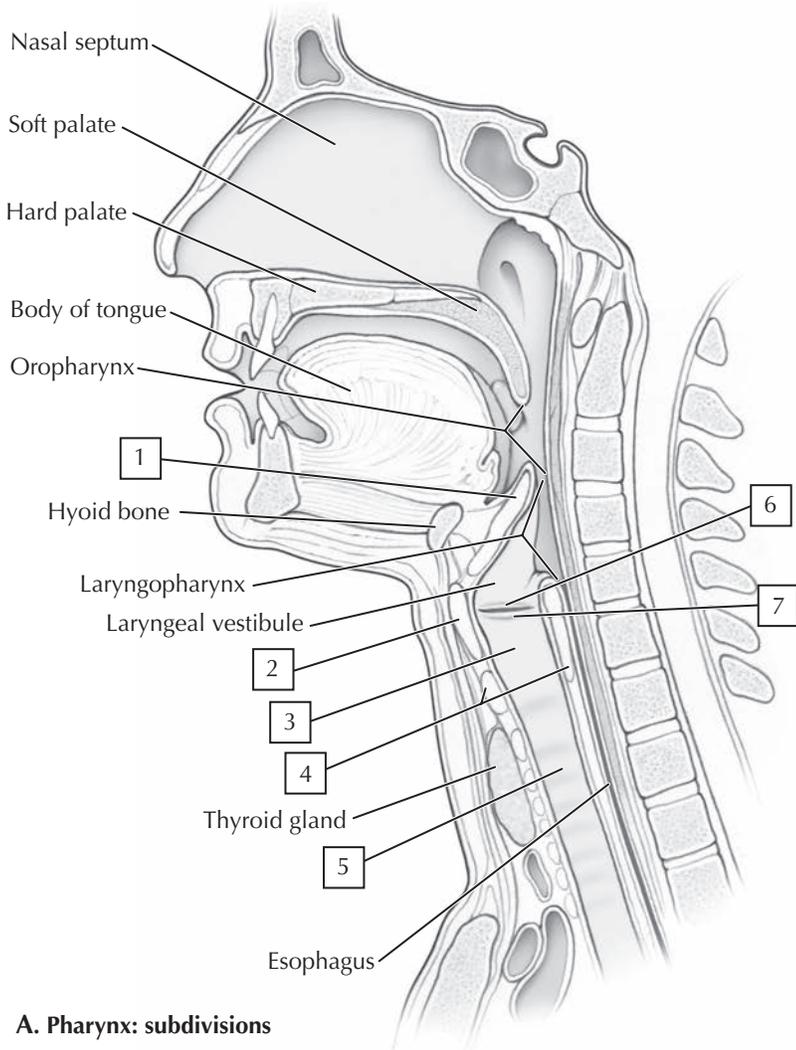
The **vestibular (false) folds** are protective in nature but the **vocal (true) folds** control phonation much like a reed instrument. Vibrations of the folds produce sounds as air passes through the rima glottidis; the pitch produced by these vibrations is dependent upon the diameter, length, thickness, and tension of the vocal folds. The size of the rima glottidis and tension on the folds is determined by the laryngeal muscles, but the amplification, resonance, and quality of the sound is a product of the shape and size of the pharynx, oral cavity, nasal and paranasal cavities, and movements of the tongue, lips, cheeks, and soft palate.

COLOR the following features of the larynx, using a different color for each feature:

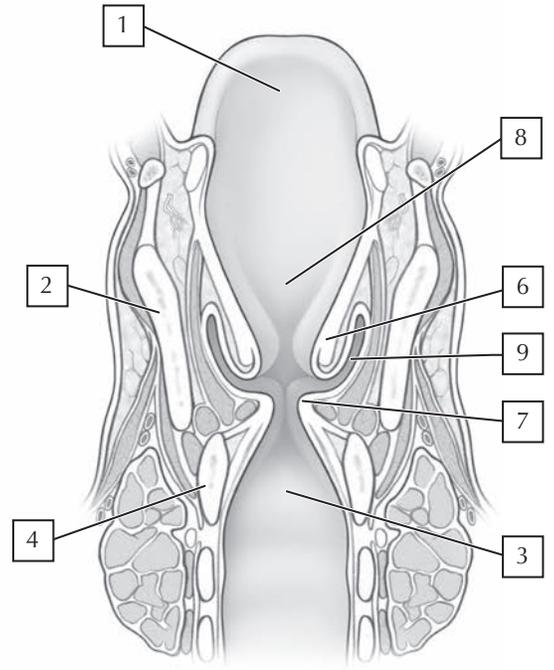
- 1. Epiglottis
- 2. Thyroid cartilage
- 3. Infraglottic cavity
- 4. Cricoid cartilage
- 5. Trachea
- 6. Vestibular folds
- 7. Vocal folds
- 8. Laryngeal vestibule
- 9. Ventricle

Clinical Note:

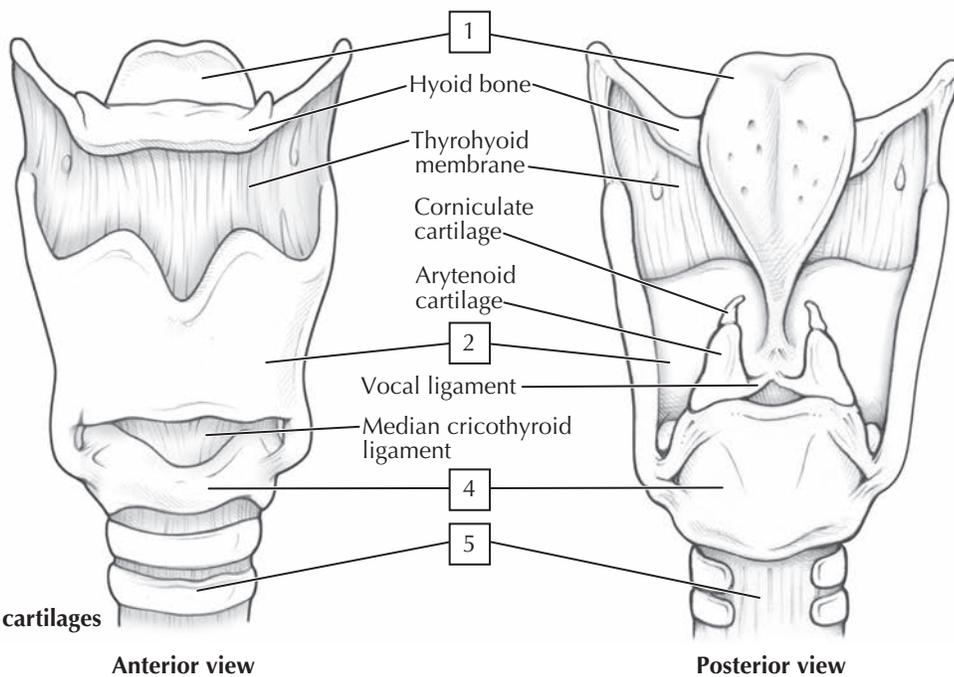
Hoarseness can be due to any condition that results in improper vibration or coaptation of the vocal folds. **Acute laryngitis** is an inflammation of the vocal folds that results in edema (swelling) of the vocal fold mucosa and usually is a result of smoking, gastroesophageal reflux disease, chronic rhinosinusitis, cough, overuse of the voice (loud yelling, talking, or singing for extended periods), myxedema, and infections.



A. Pharynx: subdivisions



B. Posterior view: coronal section



C. Neck: laryngeal cartilages

Anterior view

Posterior view

7 Trachea and Lungs

Trachea and Bronchi

The trachea (windpipe) and bronchi (primary, secondary, and tertiary) convey air to and from the lungs, and their features are summarized in the table below.

FEATURE	CHARACTERISTICS
Trachea	Is about 5 inches long and 1 inch in diameter; courses inferiorly anterior to esophagus and posterior to aortic arch
Cartilaginous rings	Are 16-20 C-shaped rings
Bronchus	Divides into right and left main (primary) bronchi at the level of the sternal angle of Louis
Right bronchus	Is shorter, wider, and more vertical than left bronchus; aspirated foreign objects more likely to pass into this bronchus
Carina	Is internal, keel-like cartilage at bifurcation of trachea
Secondary bronchi	Supply lobes of each lung (three on right, two on left side)
Tertiary bronchi	Supply bronchopulmonary segments (10 for each lung)

Beyond the tertiary bronchi, the passageways narrow considerably and eventually lose their cartilaginous support, thus forming the **bronchioles**, with a terminal bronchiole supplying a lobule of the lung. Within the lobules, the respiratory bronchioles divide into alveolar ducts, sacs, and alveoli.

COLOR the trachea and major bronchi, using a different color for each component:

- 1. Trachea
- 2. Primary (main) bronchi (right and left)
- 3. Secondary bronchi (superior, middle, and inferior on the right side; superior and inferior on the left side)
- 4. Tertiary bronchi to the 10 bronchopulmonary segments in each lung

Lungs

Each lung is invested in a layer of **visceral pleura**, which reflects off of the lung surface and then forms an outer layer of **parietal pleura** that lines the inner aspect of the thoracic cage. The pleural cavities thus are potential spaces, like the pericardial sac, that normally contain a small amount of serous fluid that lubricates the surfaces and reduces the friction during respiration. The parietal pleura is sensitive to pain (the visceral is not) and the two pleural cavities are separated from one another by the mediastinum. Features of the pleura are summarized in the table below.

FEATURE	DEFINITION
Cupula pleurae	Dome of cervical parietal pleura extending above the first rib
Parietal pleura	Membrane that in descriptive terms includes costal, mediastinal, diaphragmatic, and cervical (cupula) pleura
Pleural reflections	Points at which parietal pleura reflects off one surface and extends onto another (e.g., costal to diaphragmatic)
Pleural recesses	Reflection points at which lung does not fully extend into the pleural space (e.g., costodiaphragmatic and costomediastinal)

The right lung has three lobes and the left lung two lobes. On the medial surface of each lung is the **hilum**, which is the region where vessels, bronchi, nerves, and lymphatics enter and leave the lungs. Features of each lung are summarized in the following table.

FEATURE	CHARACTERISTICS
Lobes	Three lobes (superior, middle, inferior) in right lung; two in left
Horizontal fissure	Only on right lung, extends along line of 4th rib
Oblique fissure	On both lungs, extends from T2 vertebra to 6th costal cartilage
Impressions	Made by adjacent structures, in fixed lungs
Hilum	Points at which structures (bronchus, vessels, nerves, lymphatics) enter or leave lungs
Lingula	Tongue-shaped feature of left lung
Cardiac notch	Indentation for the heart, in left lung
Pulmonary ligament	Double layer of parietal pleura hanging from the hilum that marks reflection of visceral pleura to parietal pleura
Bronchopulmonary segment	10 functional segments in each lung supplied by a segmental bronchus and a segmental artery from the pulmonary artery

COLOR the following features of the lungs, using the colors recommended for each feature:

- 5. Pulmonary artery: carries blood from the right ventricle of the heart to the lungs for oxygenation (blue)
- 6. Bronchus (yellow)
- 7. Pulmonary veins: returns oxygenated blood to the left atrium of the heart (red)

Clinical Note:

Lung cancer is the leading cause of cancer-related death and arises either from the alveolar lining cells or from the epithelium of the tracheobronchial tree.

Aspiration of small objects (peanuts, marbles) into the lungs can block the bronchi. Usually, the object is aspirated into the right main bronchus because it is shorter, wider, and more vertical than the left main bronchus.

Generally, **chronic lung disease** can be lumped into chronic obstructive pulmonary disease (COPD) or chronic restrictive lung disease. Obstructive diseases include chronic bronchitis, asthma, and emphysema, and make it more difficult to exhale the air residing in the lung. Restrictive diseases (fibrosis) usually reduce the compliance of the lung, making it more difficult to inflate the stiffened lungs.

Pneumonia accounts for about one sixth of all deaths in the United States. Children and elderly adults are especially vulnerable to pneumococcal pneumonia, as are individuals with congestive heart failure, COPD, diabetes, or alcoholism.

