Modelling Method of Respiration Internal Organ

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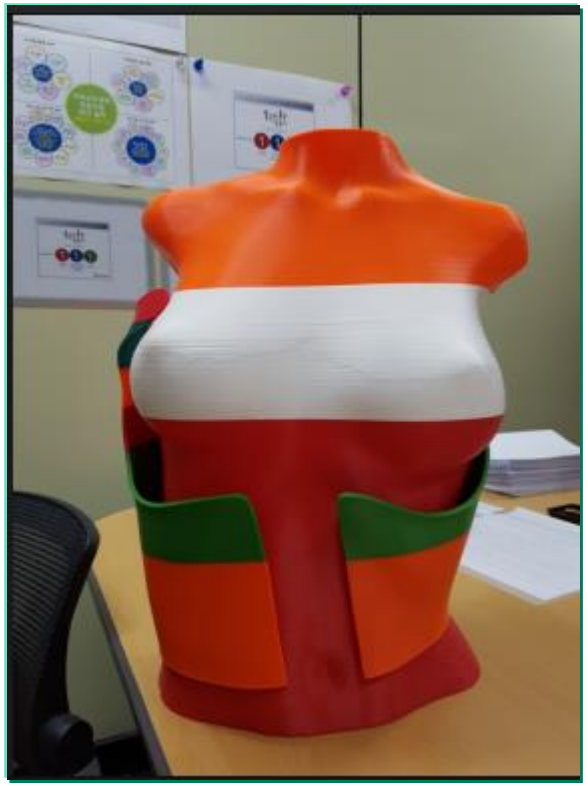
Overview

3D Printing Examples

3D Printing Examples



Human Health Application

- Bluscreen
- Camera: Chromakeying image
- Kinect : Motion Capture & Analysis
- Wearable devices: Biomedical information
- Monitor: 3D-TV
- 3D Virtual Content

Human Health Application

Silver

Basic physical exercise Yoga

Normal working
of respiration organs

Human Health Application

Estimation of Heart Rate from Galaxy Gear

Control exercise of the older person & the patient by checking the health information

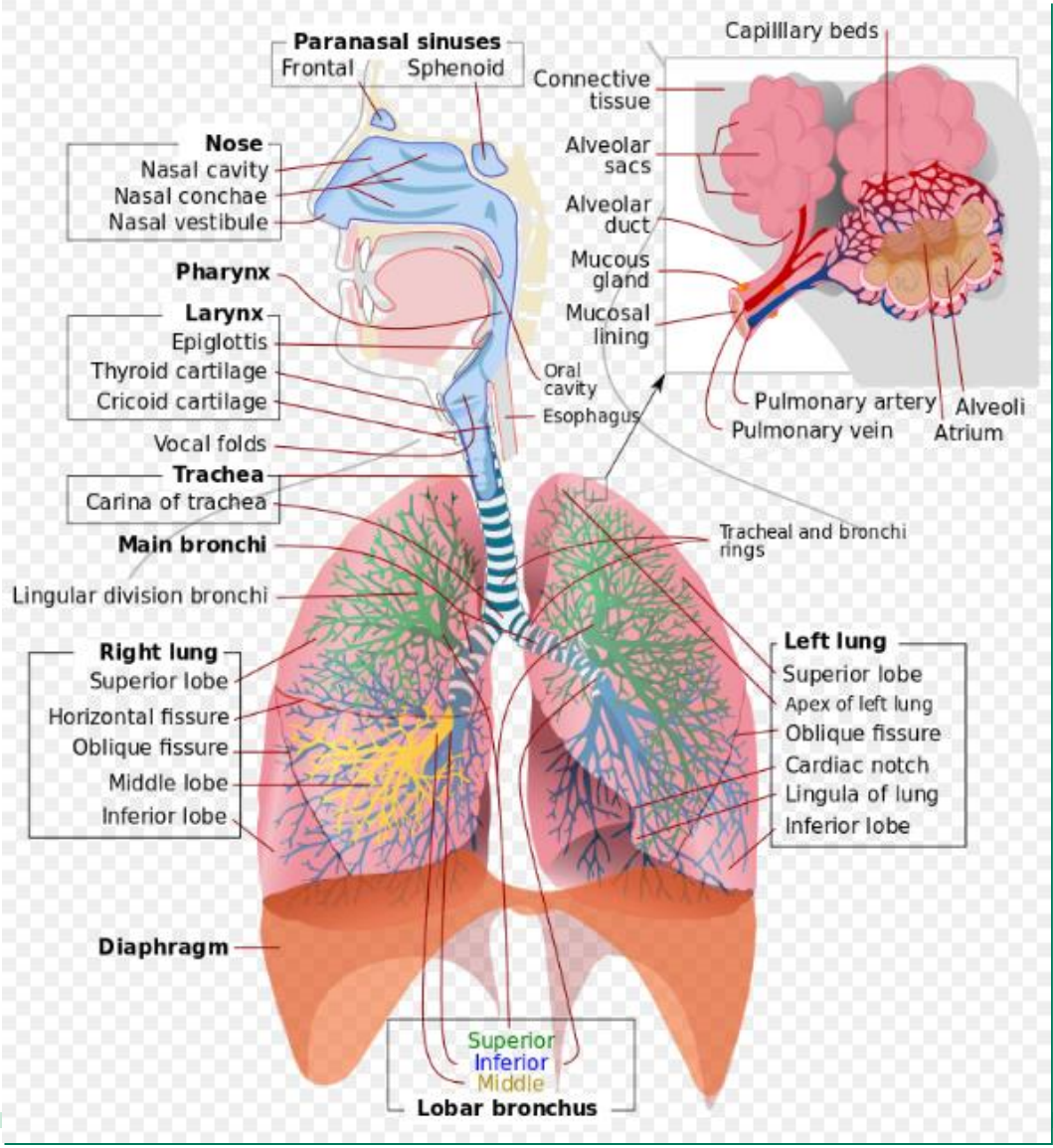
Effective management of the health information in 3D virtual human body model

Modeling and Animation of Internal Organs of Human being

Human Respiratory Internal Organ

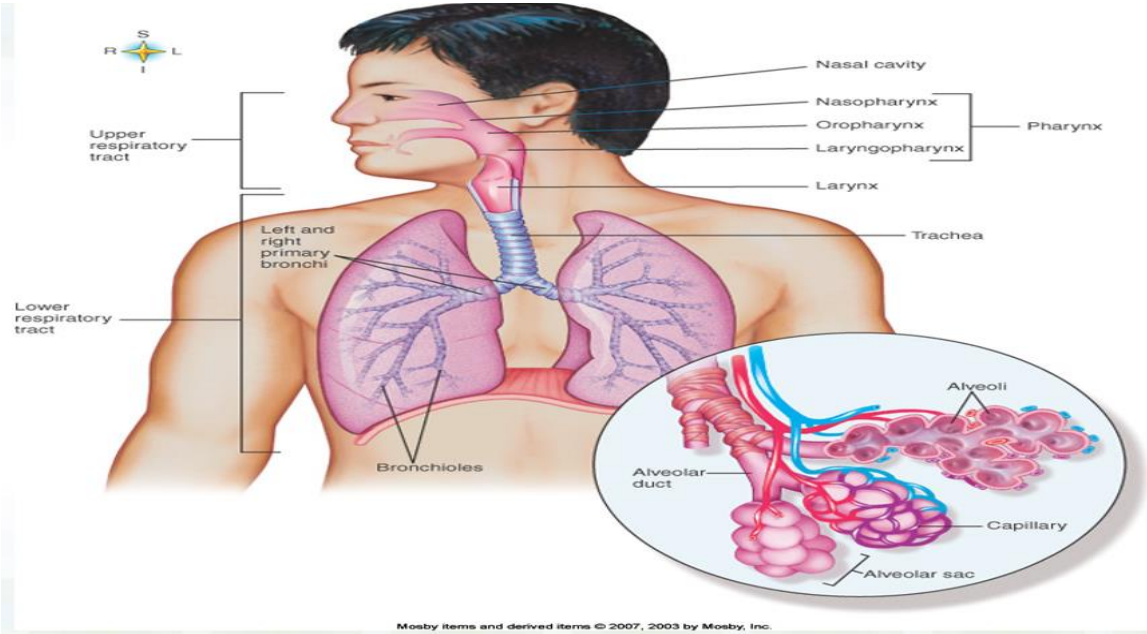
Respiration Organ System

- The respiratory system provides oxygen to the body's cells while removing carbon dioxide, a waste product that can be lethal if allowed to accumulate.
- There are many part of the respiratory include the nose, mouth, pharynx(인 두), larynx(후 두), trachea(기도), bronchi (기관지염), and bronchioles(세시관지), etc.



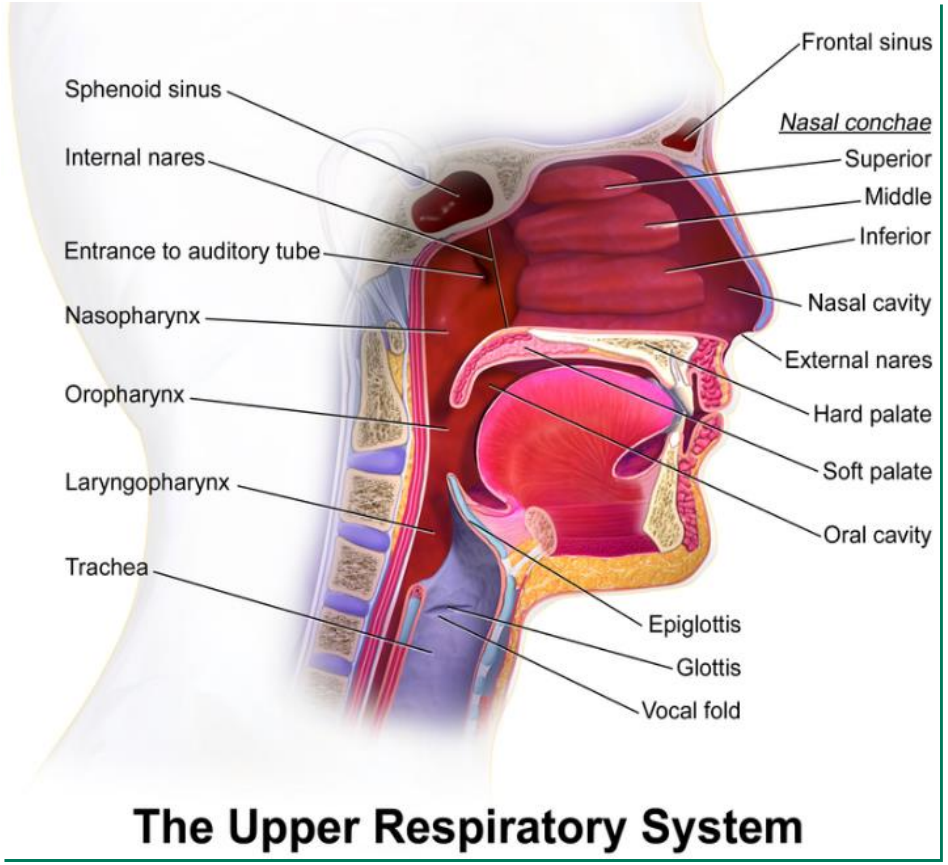
Respiration Organ System

- We have created 3D of respiratory representation model system in the purpose of:
  - Analyzing the each part of respiratory model
  - Showing explanation of each part
  - Being able to change to another model object
- There are two major parts in this system: lower respiratory and upper respiratory system.



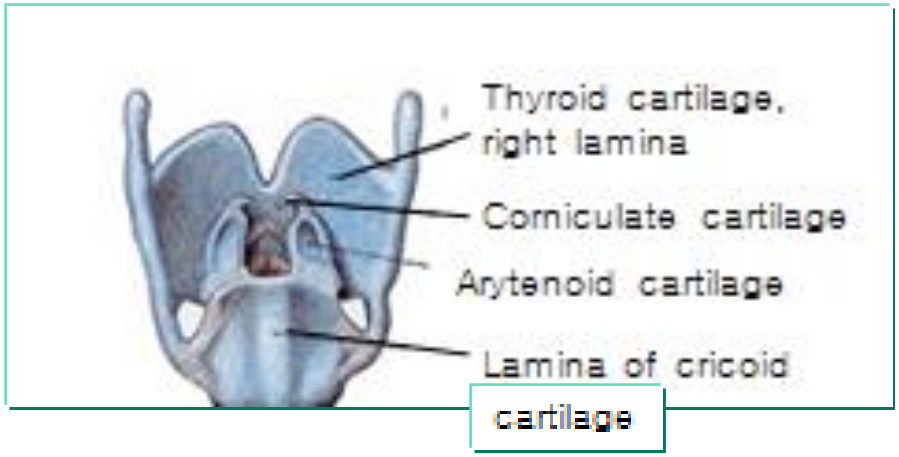
Names of Upper Respiration Organ

- The parts of the respiratory system lying above the sternal angle (outside of the thorax), above the glottis(vocal cords), or above the cricoid cartilage.
- The **nose** and **nasal cavity** are the first section of the body's airway.
- **Pharynx**, also know as the throat – is divided into 3 regions; the **nasopharynx, oropharynx, and laryngopharynx**.
- **Larynx**, also know as the voice box, is a short section of the airway that connects the laryngopharynx and the trachea and has the associated cartilage that produces sound.

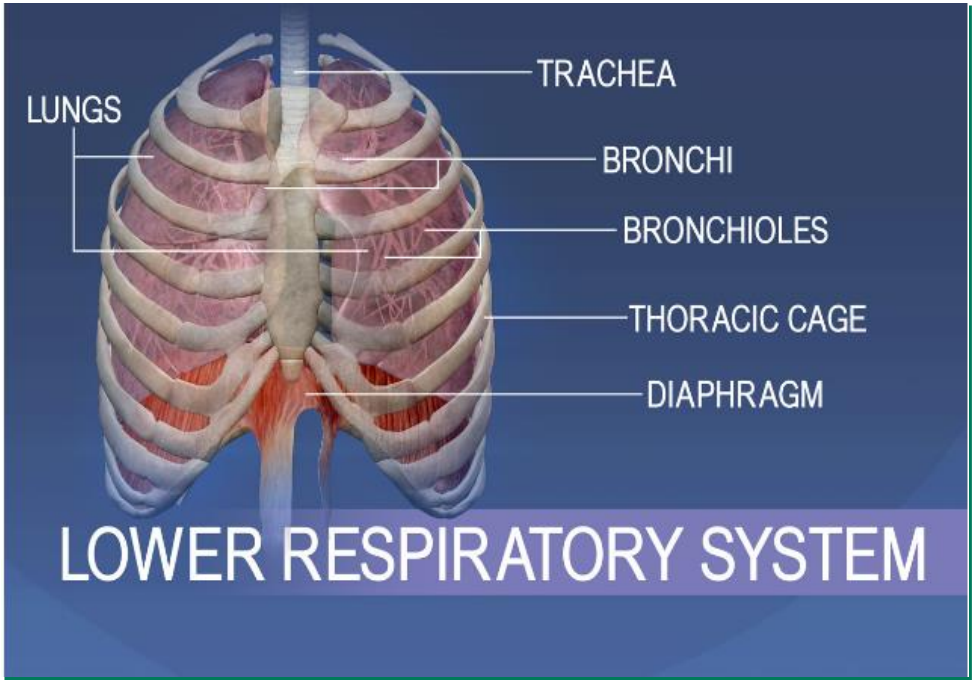


The Upper Respiratory System

https://en.wikipedia.org/wiki/Respiratory_tractt


Thyroid cartilage, right lamina
Corniculate cartilage
Arytenoid cartilage
Lamina of cricoid cartilage

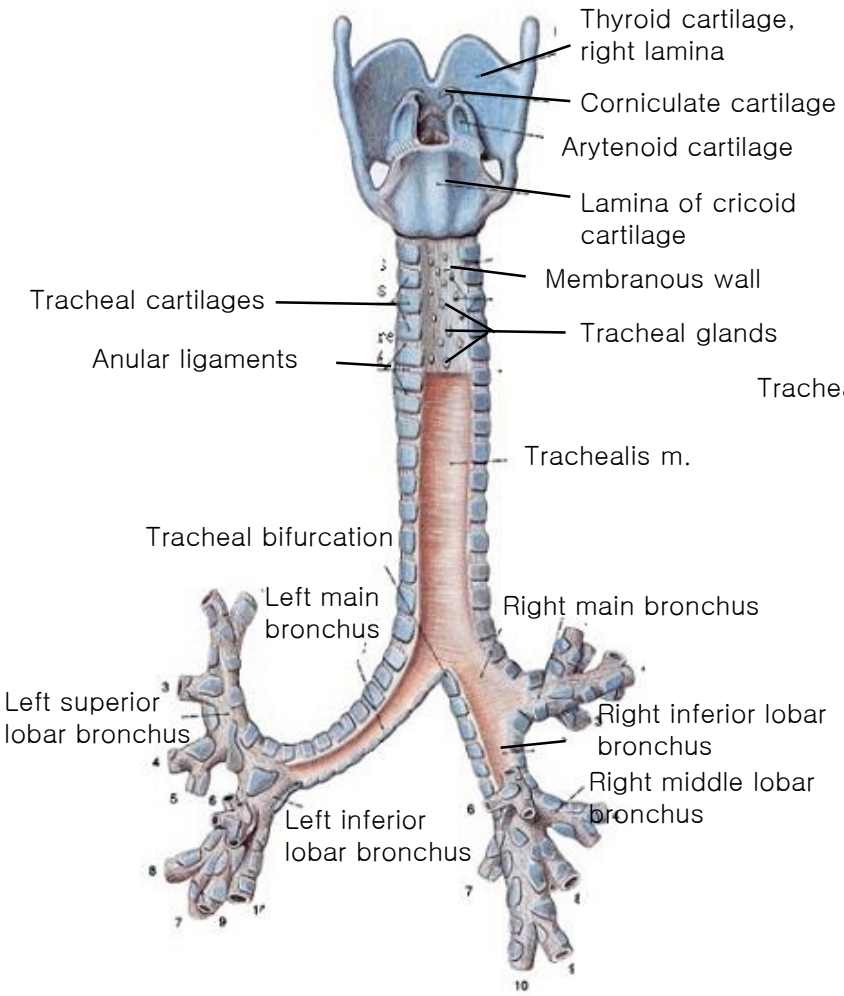
Names of Lower Respiration Organ

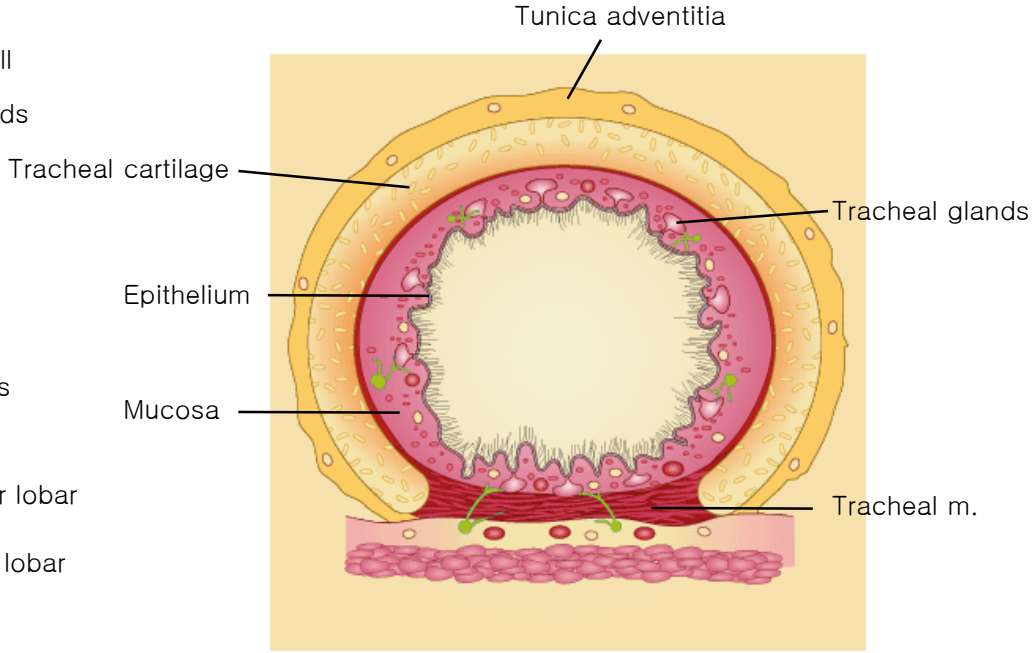


- The lower respiratory tract or lower airway is derived from the developing foregut and consists of the trachea, bronchi (primary, secondary and tertiary), bronchioles (including terminal and respiratory), and lungs (including alveoli.) It also sometimes includes the larynx.

https://en.wikipedia.org/wiki/Respiratory_tractt

Larynx & Trachea structure



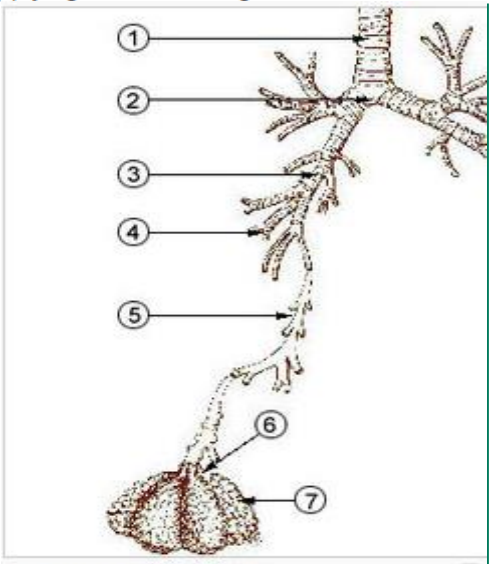


Names of Respiration Organ-Respiration tree

Respiratory tree [edit]

The **respiratory tree** or **tracheobronchial tree** is a term also used to refer to the branching structure of airways supplying air to the lungs and includes the trachea, bronchi and bronchioles.

- trachea
  - main bronchus
    - lobar bronchus
      - segmental bronchus
        - conducting bronchiole
          - terminal bronchiole
            - respiratory bronchiole
              - alveolar duct
                - alveolar sac
                  - alveolus



1. Trachea
2. Mainstem bronchus
3. Lobar bronchus
4. Segmental bronchus
5. Bronchiole
6. Alveolar duct
7. Alveolus

https://en.wikipedia.org/wiki/Respiratory_tractt


허파꼭대기
Apex of lung
위엽
Superior lobe
빗틈새
Oblique fissure
위엽, 갈비면
Superior lobe, costal surface
앞모서리
Anterior border
오른허파수평틈새
Horizontal fissure of right lung
아래엽, 갈비면
Inferior lobe, costal surface
오른허파중간엽, 갈비면
Middle lobe of right lung, costal surface
아래엽
Inferior lobe
빗틈새
Oblique fissure
아래모서리
Inferior border

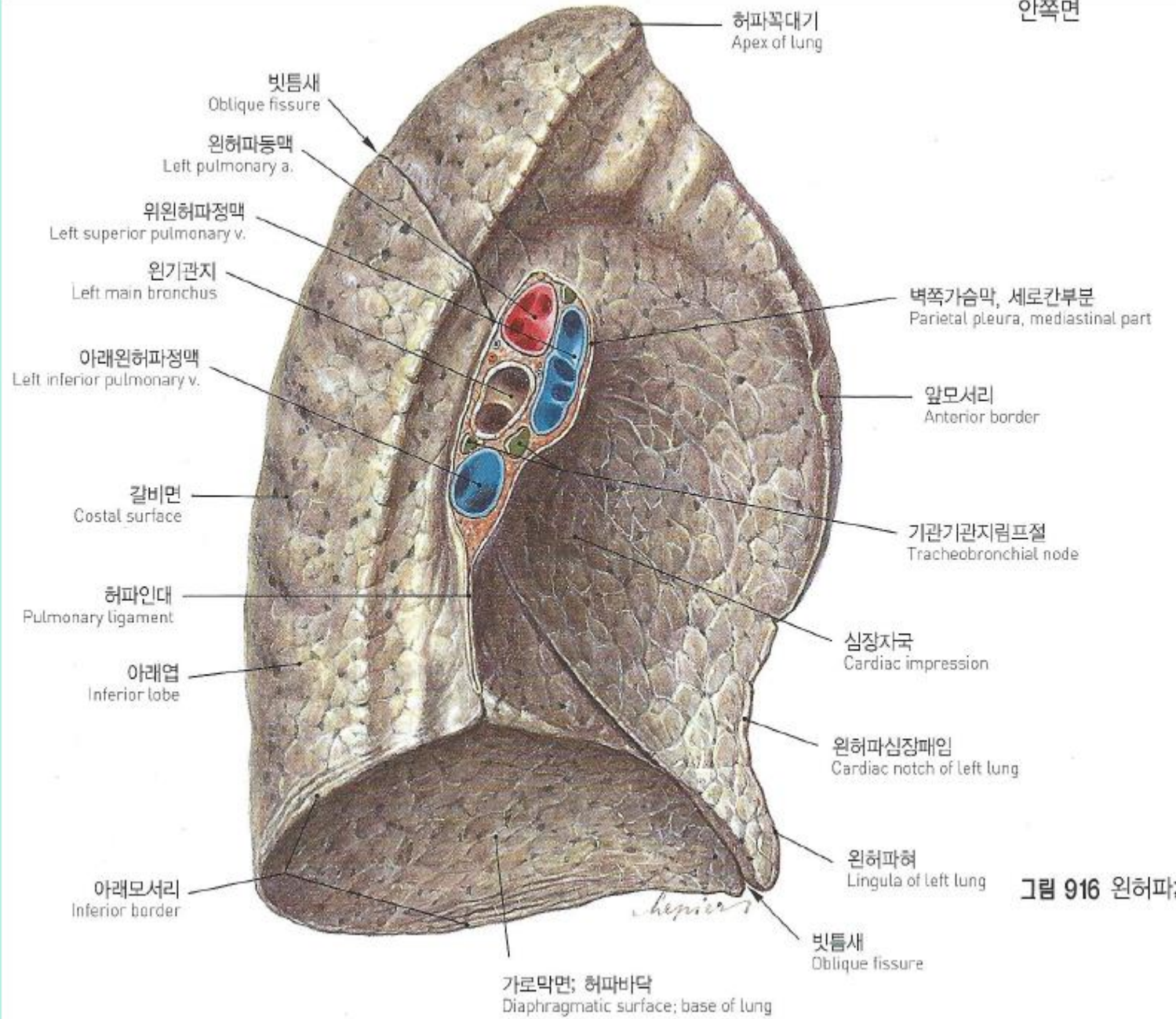


그림 916 왼허파; 허파문에서의 시상단면; 안쪽면

Names of Respiration Organ Tracts

Upper Respiration

- paranasal sinuses (코곁)
- nasal (코)
- pharynx(인두)
- larynx (후두)
- trachea(기관)

Lower Respiration

- trachea (기관)
- main bronchi (주 기관지)
- lobar bronchus (엽 기관지)
- segmental bronchus (분절 기관지)
- conducting bronchiole (지휘 세 기관지)
- terminal bronchiole (종단 세 기관지)
- respiratory bronchiole (호흡 세 기관지)
- alveolar duct (폐포 관)
- alveolar sac (폐포 낭)
- alveolus (치조)
- right lung (오른쪽폐)
- left lung (왼쪽폐)
- diaphragm (횡경막)

Table of Respiration Organ Tracts

Main Classification	Level1	Level 2
Upper Respiration Tract	Paranasal sinuses (코곁)	Frontal (정면)
		Sphenoid (형상골)
		Ethmoid (사골)
		Maxillary (상악)
	Nose (코)	Nasal Cavity
		Nasal Conchae
		Nasal Vestibule
		Olfactory epithelium
		Internal Naris
		External Naris
	Pharynx (인두)	Oral Cavity
		Nasopharynx
		Oropharynx
		Laryngopharynx
	Larynx (후두)	Epiglottis
		Thyroid Cartilage
		Cricoid Cartilage
		Arytenoid
		Cornculate
		Cuneiform
		Laryngeal cartilage
		Hyoid bone
		Membrane
		Ligament

Table of Respiration Organ Tracts

호흡기관 대분류	호흡기관 중분류	호흡기관 세부항목
Lower Respiration Tract	Trachea	Tracheal cartilage Anular ligament Tracheal gland Tracheal m. Membranous wall Tunica adventitia Epithelium Mucosa
	Left Primary Bronchus	Left Bronchial Tree (Left Secondary Bronchi)
	Left Lobar Bronchus	Bronchiole – Terminal Bronchiole – Respiration Bronchiole Respiration Portion (Alveolar Duct – Alveolar Sac - Alveolus)

Table of Respiration Organ Tracts

Lower Respiration Tract	Left Lung	Superior lobe Apex of lung
		Horizontal Fissure
		Oblique Fissure
		Middle Lobe
		Inferior lobe Inferior border
		Left pulmonary a. Left superior pulmonary v. Left main bronchus Left inferior pulmonary v. Costal surface Pulmonary ligament Parietal pleura, mediastinal part Anterior border Tracheobronchial node Cardiac impression Cardiac notch of left lung Lingula of left lung Diaphragmatic surface; base of lung

Table of Respiration Organ Tracts

Lower Respiration Tract	Right Primary Bronchus	Right Bronchial Tree (Right Secondary Bronchi)
	Right Lobar Bronchus	Bronchiole – Terminal Bronchiole – Respiration Bronchiole Respiration Portion (Alveolar Duct – Alveolar Sac - Alveolus)

Table of Respiration Organ Tracts

Lower Respiration Tract	Right Lung	Superior lobe Apex of lung
		Horizontal Fissure
		Oblique Fissure
		Middle Lobe
		Inferior Lobe Inferior border
		Right pulmonary a. Anterior border Right pulmonary v. Cardiac impression Right superior lobar bronchus Right main bronchus Right middle and right inferior lobar bronchi Inferior tracheobronchial node Parietal pleura, mediastinal part Pulmonary ligament Diaphragmatic surface; base of lung

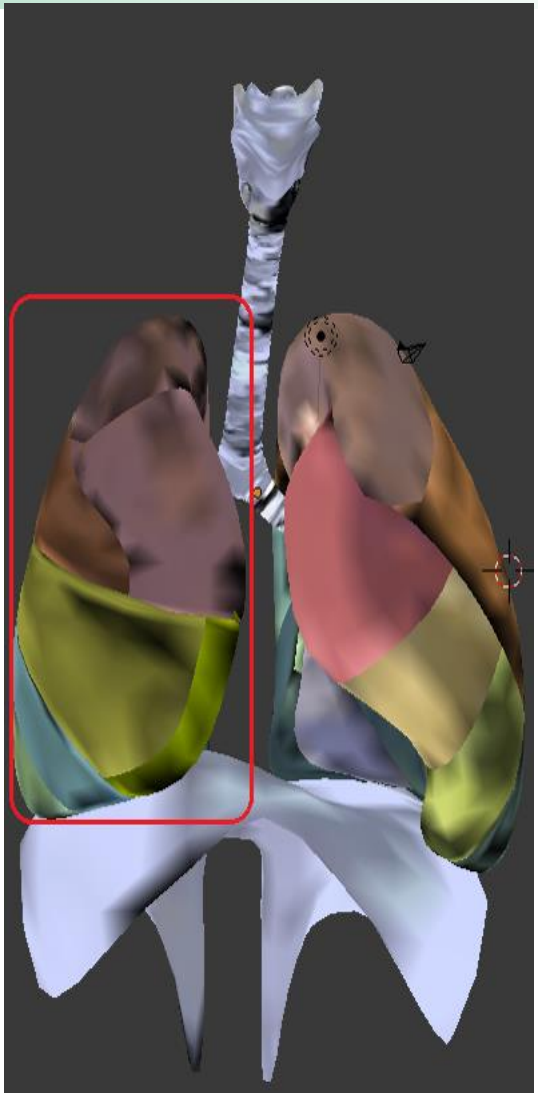
Table of Respiration Organ Tracts

Lower Respiration Tract	Diaphragm	Interior vena cava
		Phrenic nerve distribution on thoracic side
		Right phrenic nerve
		Left phrenic nerve
		Esophagus
		Right phrenic artery
		Left phrenic artery
		Aorta

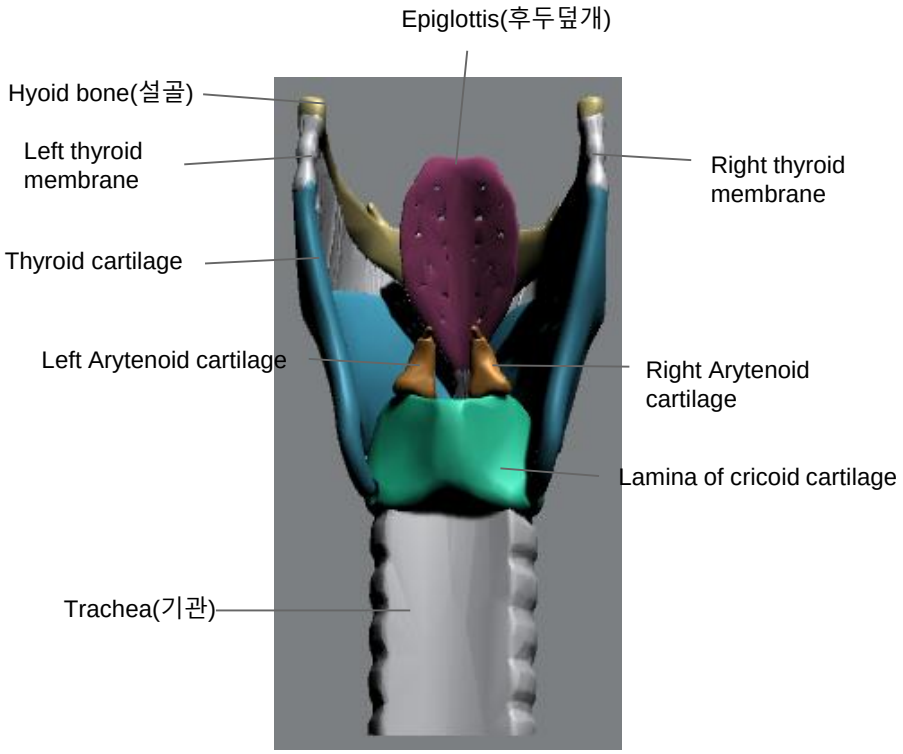
Visualization System for Representing Respiratory Internal Organ

Whole model

- There are two 3D object models of the respiratory system:
  lower and
  upper respiratory system.

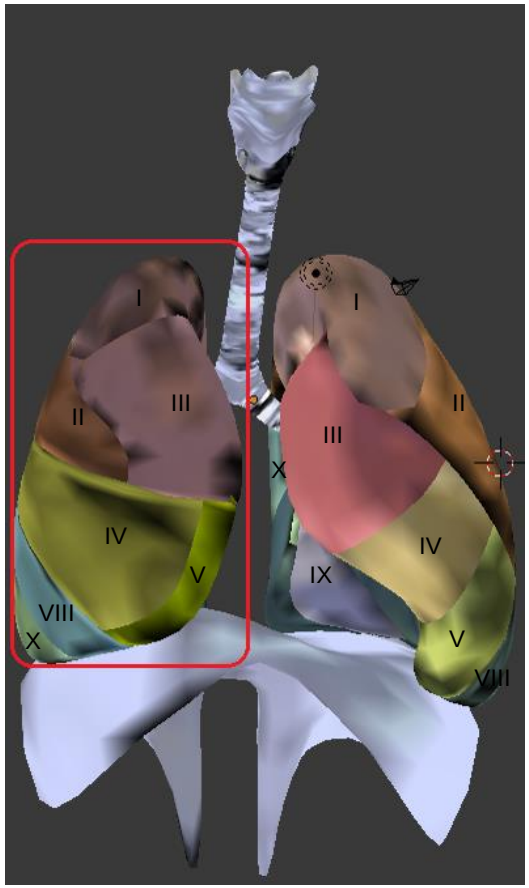


Upper Respiratory of Larynx



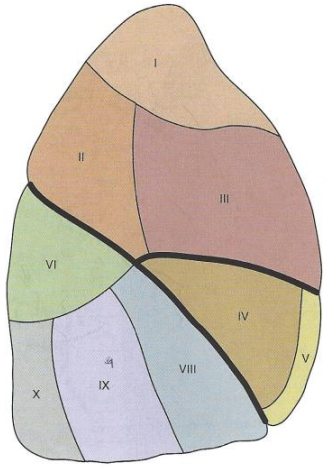
Upper Respiratory Organ of Larynx

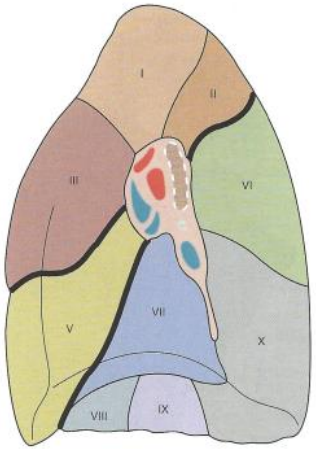
Partition of Right Lung



Lower Respiratory Organ (Right Lung)

Right Lung





오른허파 Right lung

오른허파, 위엽 Right lung, superior lobe

- 꼭대기구역 Apical segment [S I]
- 뒤구역 Posterior segment [S II]
- 앞구역 Anterior segment [S III]

오른허파, 중간엽 Right lung, middle lobe

- 가쪽구역 Lateral segment [S IV]
- 안쪽구역 medial segment [S V]

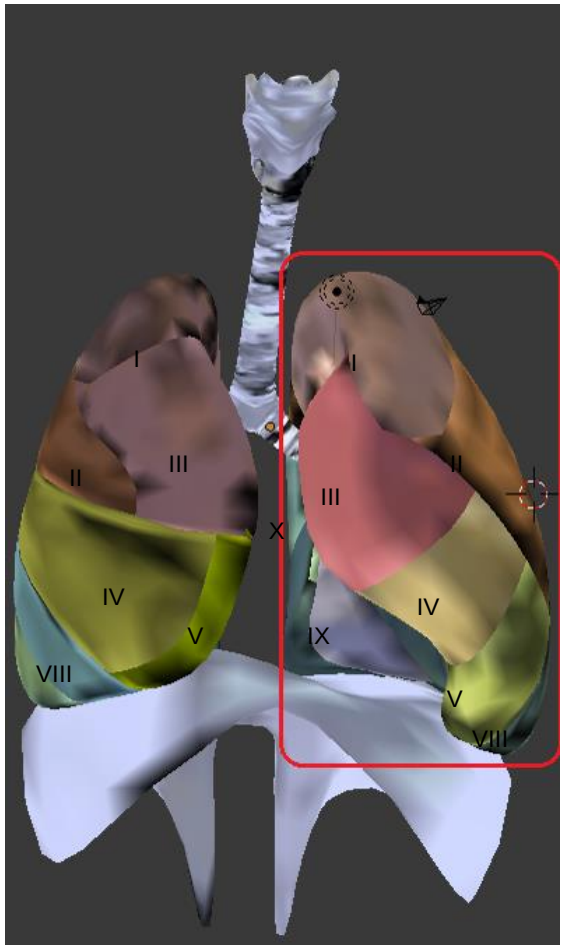
오른허파, 아래엽 Right lung, middle lobe

- 위구역 Superior segment [S VI]
- 안쪽바닥구역 Medial basal segment [S VII]*
- 앞바닥구역 Aneterior basal segment [S VIII]
- 가쪽바닥구역 Lateral basal segment [S IX]
- 뒤바닥구역 Posterior basal segement [S X]

* 이 구역은 일반적으로 독립적인 구역이 아니며, 다소 앞바닥구역과 붙어있다[SVIII].

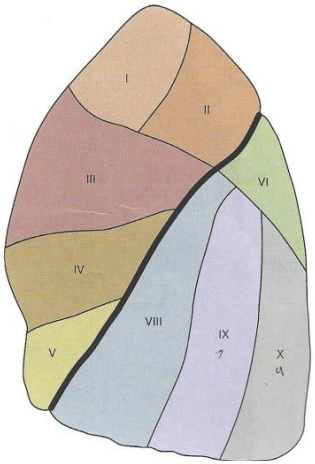
그림 917 오른허파; 기관지허파구역; 가쪽면

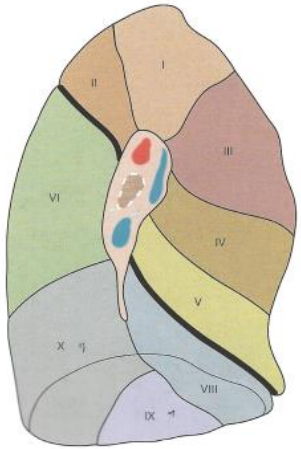
Partition of Left Lung



Lower Respiratory Organ (Left Lung)

Left Lung





왼허파 Left lung

왼허파, 위엽 Left lung, superior lobe

- 꼭대기뒤구역 Apicoposterior segment [SI + II]
- 앞구역 Anterior segment [S III]
- 위혀구역 Superior lingular segment [S IV]
- 아래혀구역 Inferior lingular segment [S V]

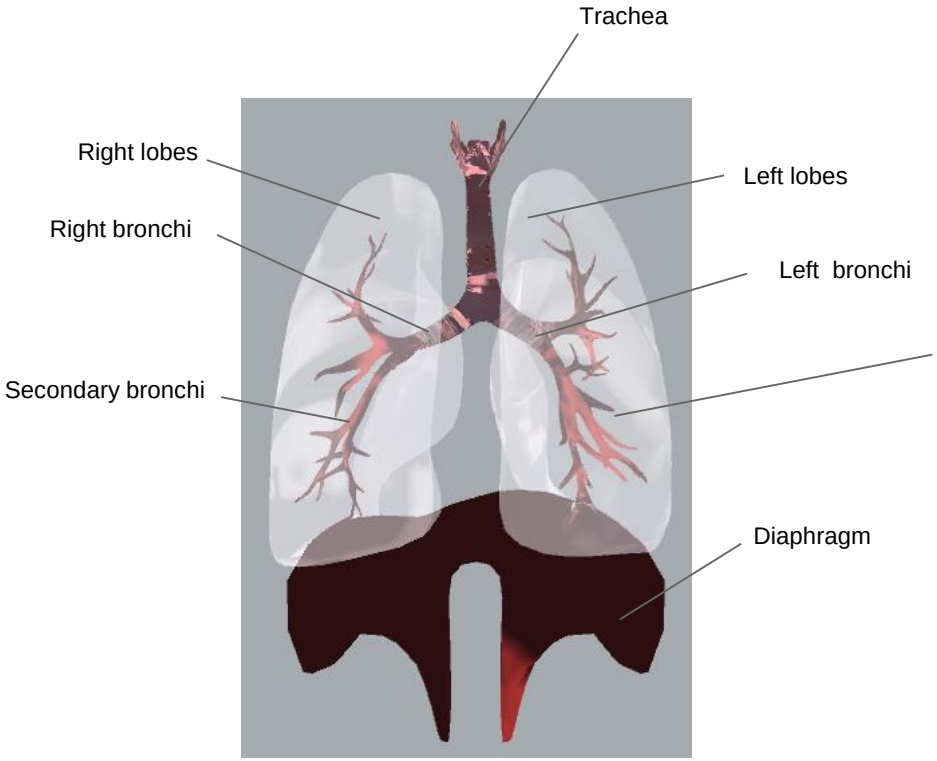
왼허파, 아래엽 Left lung, inferior lobe

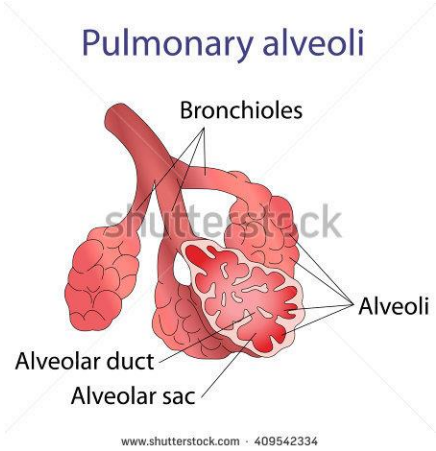
- 위구역 Superior segment [S VI]
- 안쪽바닥구역 Medial basal segment [S VII]*
- 앞바닥구역 Anterior basal segment [S VIII]
- 가쪽바닥구역 Lateral basal segment [S IX]
- 뒤바닥구역 Posterior basal segement [S X]

* 이 구역은 일반적으로 독립적인 구역은 아니며, 다소 앞바닥구역과 붙어있다[S VIII].

그림 918 왼허파; 기관지허파구역; 가쪽면

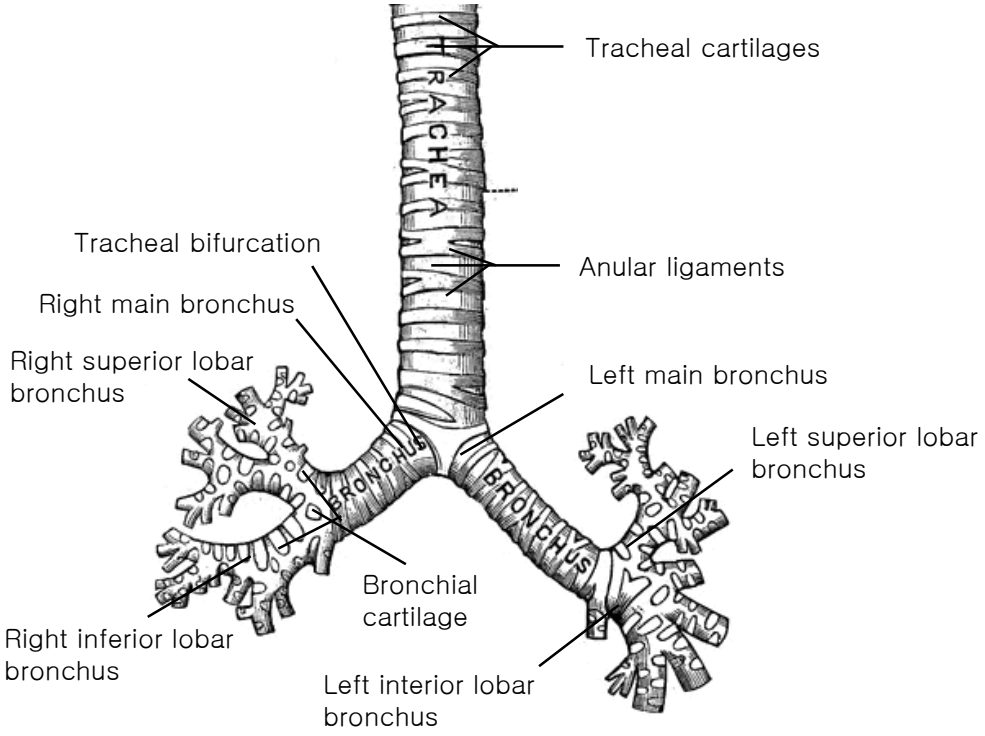
Lower Respiratory of Lung





Lower Respiratory Organ

Partition of Trachea and bronchi



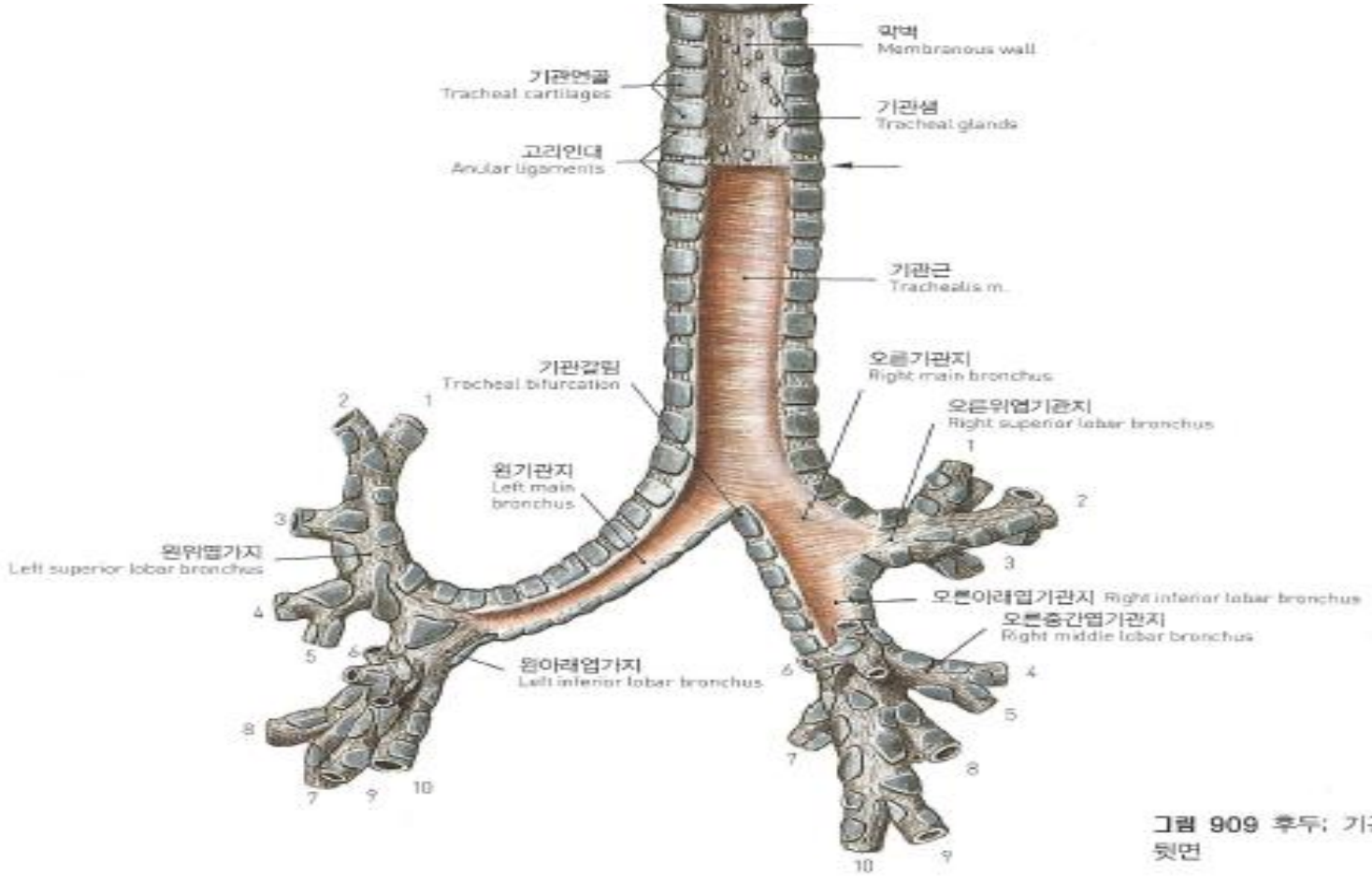


그림 909 후두; 기관과 기관지; 뒷면

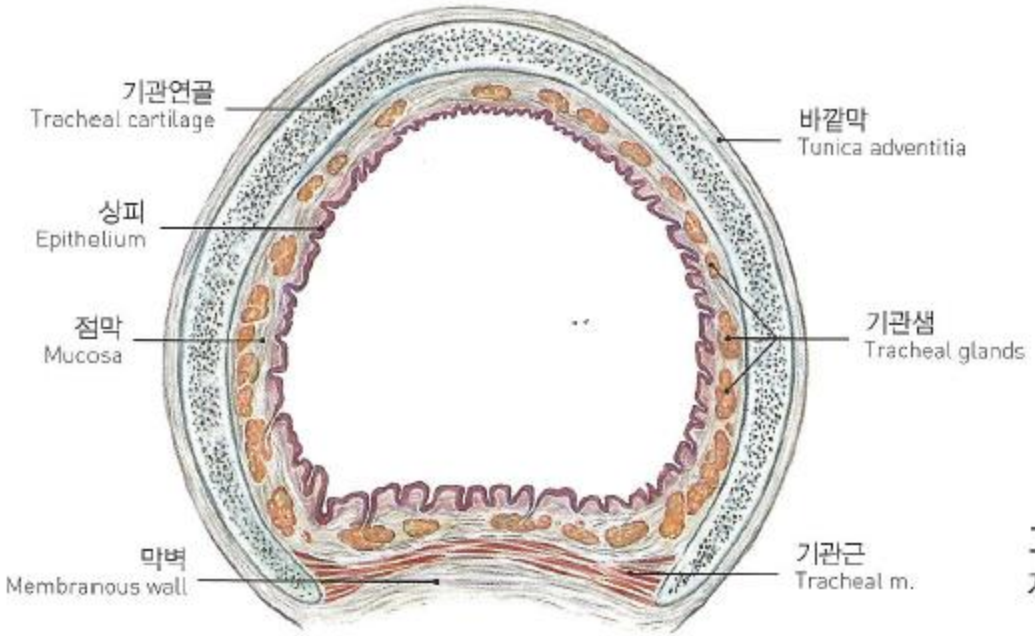
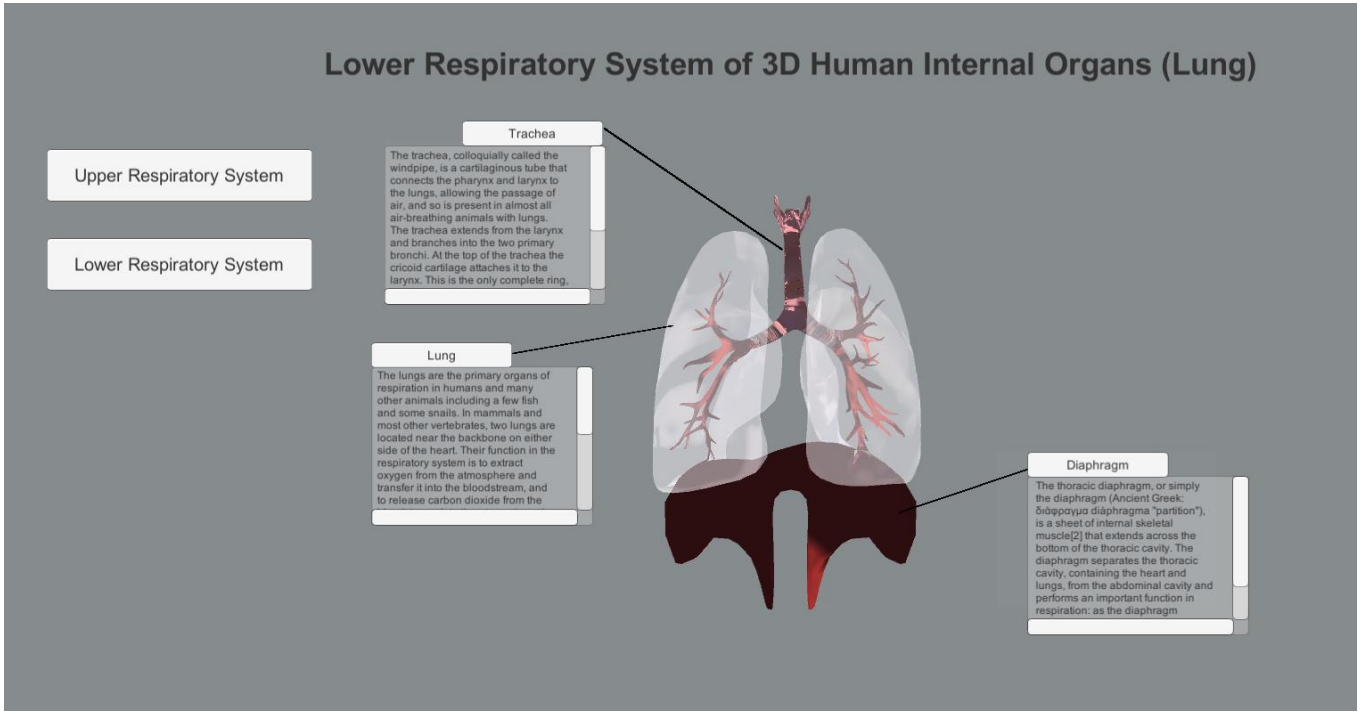
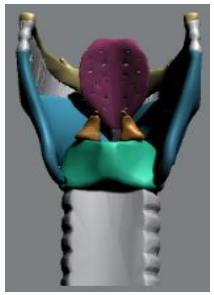
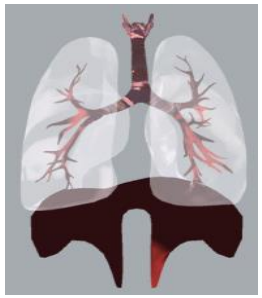


그림 910 기관; 가로단면; 현미경 저배율 확대

- 3D object Event
  - Click on each model object to show model title button
  - Click on each model title button to show model detail description
- Menu Option Button Event
  - Click on 1st option to switch to upper model object (new scene)
  - Click on 2nd option to stay on current model object (current scene)



Respiratory Organs Development

3D models of lower and upper respiratory

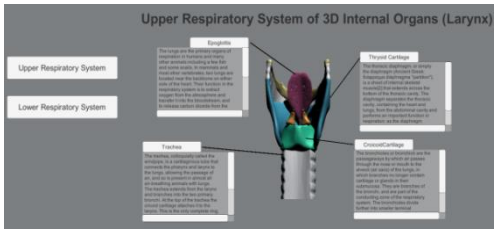
Import

Development Features

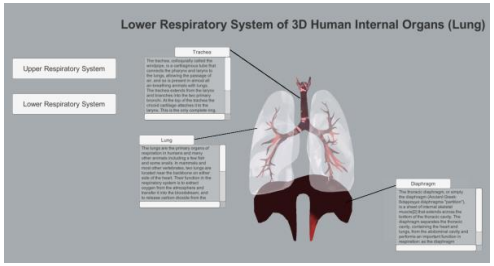
We have imported those 3D models to create some features:

- Scene/ add object
- UI buttons and panels
- Menu option to switch objects
- Script events

create



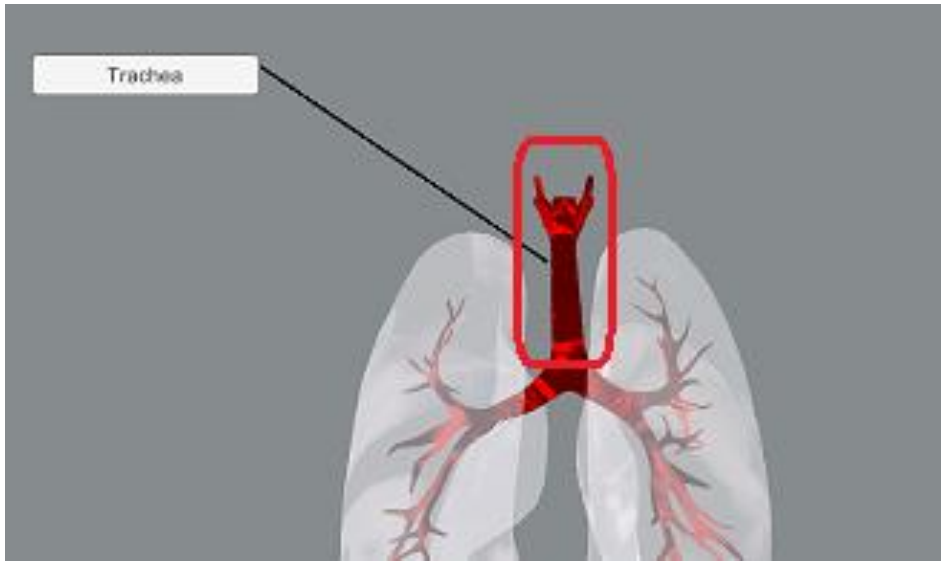
Upper Respiratory Tract



Lower Respiratory Tract

C# Script Event

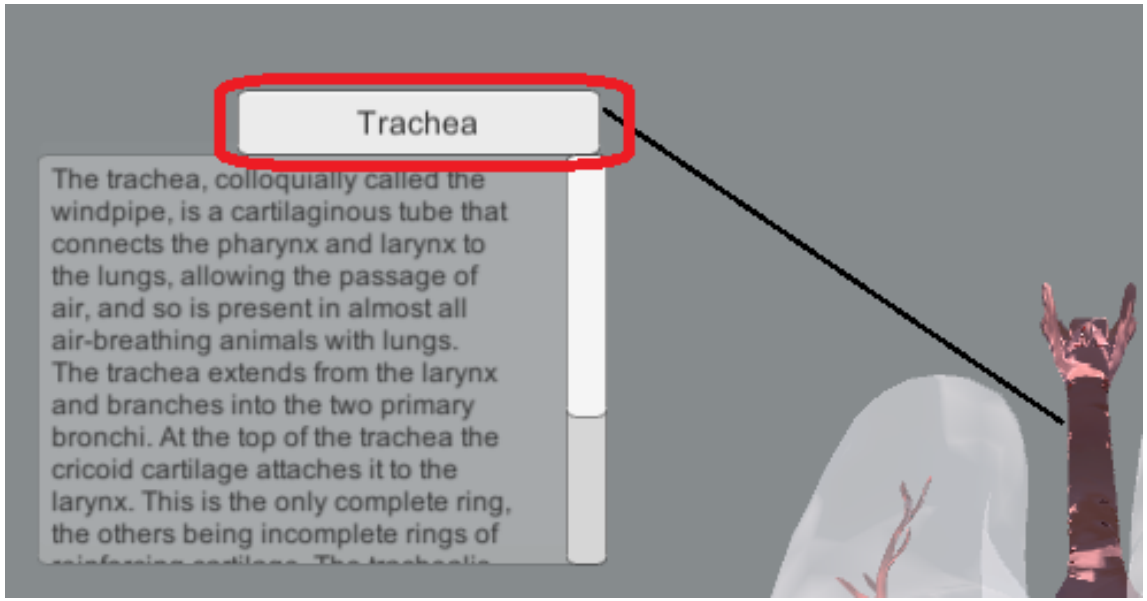
1. Click on object part to show object title button




```
void OnMouseDown()
{
    GameObject.FindGameObjectWithTag("btnLung").SetActive(true);
    btnLung.gameObject.SetActive(true);
    // mesh = this.gameObject.GetComponent<MeshRenderer>();
    switch (this.gameObject.name)
    {
        case "Trachea":
            Debug.Log("Trachea");
            // call method to clear panel
            panel.clearPanel(panelLung);
            panel.clearPanel(panelDiaphragm);
            // call method to show and hide button
            showHideButton("btnLung", false, 0, 0, 0);
            showHideButton("btnDiaphragm", false, 0, 0, 0);
            showHideButton("btnTrachea", true, 1, 1, 1);
            //showHideLine(lineTrachea, true);
            showHideLine(lineLung, false);
            showHideLine(lineDiaphragm, false);
            lineTrachea.GetComponent<Renderer>().enabled = true;
            mesh.material.color = Color.red;
            break;
        case "Lung":
            Debug.Log("Lung");
            // call method to clear panel
            panel.clearPanel(panelTrachea);
            panel.clearPanel(panelDiaphragm);

            // call method to show and hide button
            showHideButton("btnTrachea", false, 0, 0, 0);
            showHideButton("btnDiaphragm", false, 0, 0, 0);
            showHideButton("btnLung", true, 1,  1, 1);

            //showHideLine(lineLung, true);
```

C# Script Event

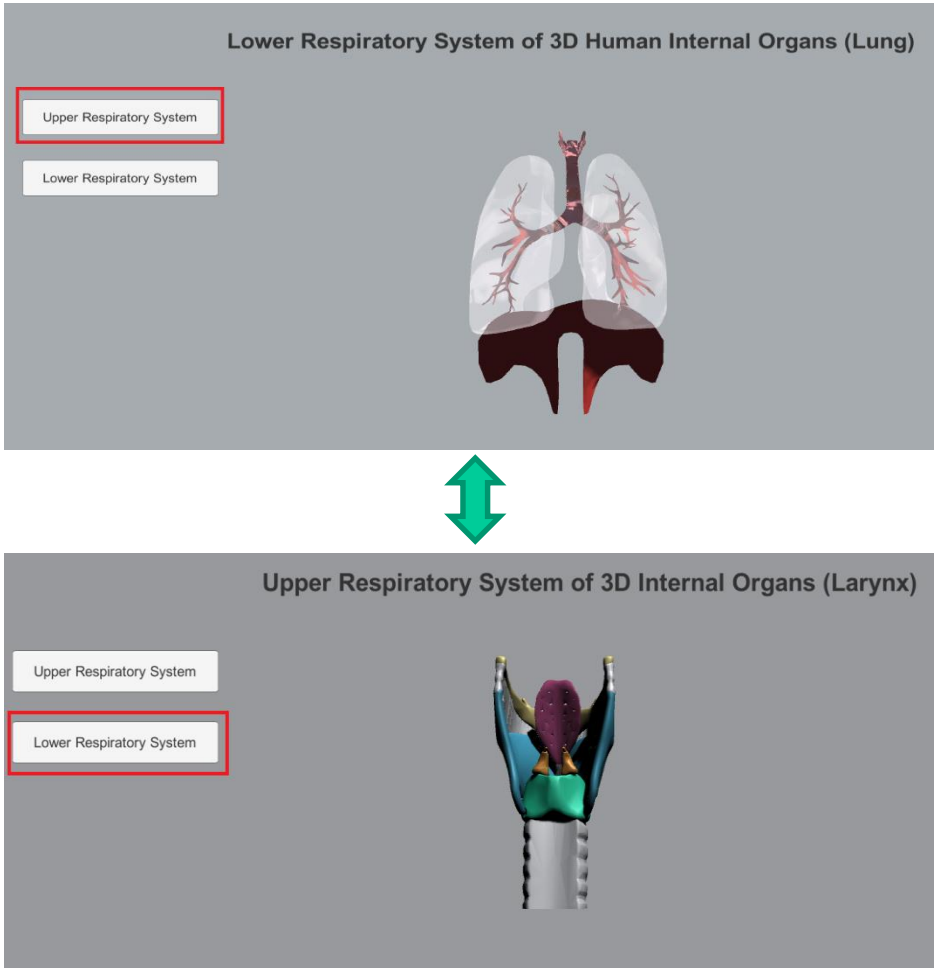
2. Click on model title button to show model detail




```
public class PanelScript : MonoBehaviour {

    public GameObject panelLung, panelDiaphragm, panelTrachea;
    private int lungCounter;
    private int diaphragmCounter;
    private int tracheaCounter;

    // Use this for initialization
    void Start()
    {
        Debug.Log("START");
        lungCounter++;
        diaphragmCounter++;
        tracheaCounter++;
        panelLung = GameObject.Find("PanelLung");
        panelDiaphragm = GameObject.Find("PanelDiaphragm");
        panelTrachea = GameObject.Find("PanelTrachea");
        clearPanel(panelLung);
        clearPanel(panelDiaphragm);
        clearPanel(panelTrachea);
    }

    public void hideshowPanelTrachea()
    {
        tracheaCounter++;
        diaphragmCounter = 1;
        lungCounter = 1;
        if (tracheaCounter % 2 == 1)
        {
            Debug.Log(tracheaCounter + " HIDE TRACHEA");
            panelTrachea.gameObject.SetActive(false);
        }
        else
        {
            Debug.Log(tracheaCounter + " SHOW TRACHEA");
            panelTrachea.gameObject.SetActive(true);
        }
    }
```

C# Script Event

3. Click on menu button to switch object model (scene)




```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityEngine.UI;
using UnityEngine.SceneManagement;

public class ButtonActionClickScript : MonoBehaviour {

    private Button respirat, larynx;
    void Start()
    {
        respirat = GameObject.Find("Res").GetComponent<Button>();
        larynx = GameObject.Find("Larynx").GetComponent<Button>();

        // Event button click
        respirat.onClick.AddListener(UpperClick);
        larynx.onClick.AddListener(LowerClick);
    }

    public void UpperClick()
    {
        Debug.Log("RespiratoryClick");
        //Application.LoadLevel("Larynx_System");
        SceneManager.LoadScene("Larynx_System", LoadSceneMode.Single);
    }

    public void LowerClick()
    {
        Debug.Log("LungClick");
        SceneManager.LoadScene("Lung", LoadSceneMode.Single);
    }
}
```

Thank you!