Anatomy of the Respiratory System

Pharmacotherapy II

Spring Semester 2020

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***Reference*- except as indicated, all figures in the lecture slides are from Mariab, Mallatt & Wilhelm, *Human Anatomy*, 4th ed, 2005 (available in library).**

***Objectives*- The student can identify the following structures and explain the general role of each structure in the function of the respiratory system:**

- **Extrathoracic structures**
  - **Nasal turbinates**
  - **Epiglottis**
  - **Larynx**
  - **Trachea**
- **Thorax**
  - **Chest wall and muscles of breathing**
    - **Ribs, sternum**
    - **Intercostal muscles (intercostal nerves)**
    - **Diaphragm (phrenic nerves)**
  - **Thoracic divisions**
    - **Pleura and lungs**
    - **Pericardium and heart**
    - **Mediastinum**
- **Lungs**
  - **Lobes of right and left lungs**
  - **Conducting airways**
    - **Bronchi**
    - **Bronchioles**
    - **Cartilage, smooth muscle, mucus glands and goblet cells, ciliated epithelium**
  - **Gas exchange areas**
    - **Alveoli**
  - **Pulmonary circulation**
    - **Pulmonary arteries**
    - **Alveolar capillaries**
    - **Pulmonary veins**
  - **Pulmonary lymphatic system**
  - **Bronchial circulation**

Extrathoracic Structures

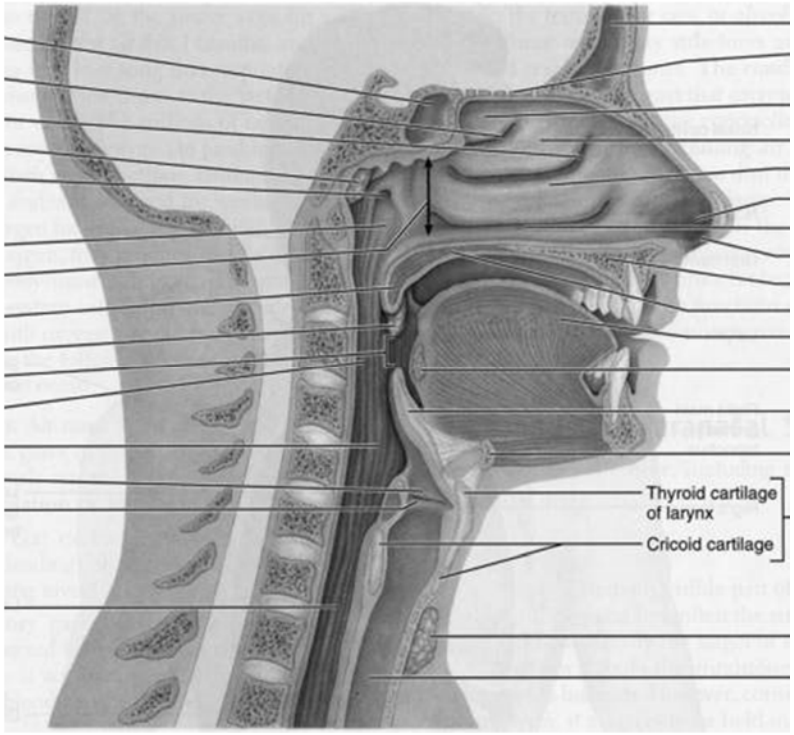


Fig. 21.3

Turbinates (concha)

- ***Warm/humidify air***
- ***Remove particles from air***

Epiglottis

- ***Protects airway opening***

Larynx

- ***Phonation***

Trachea

- ***1st generation of airways***

Thoracic Cage

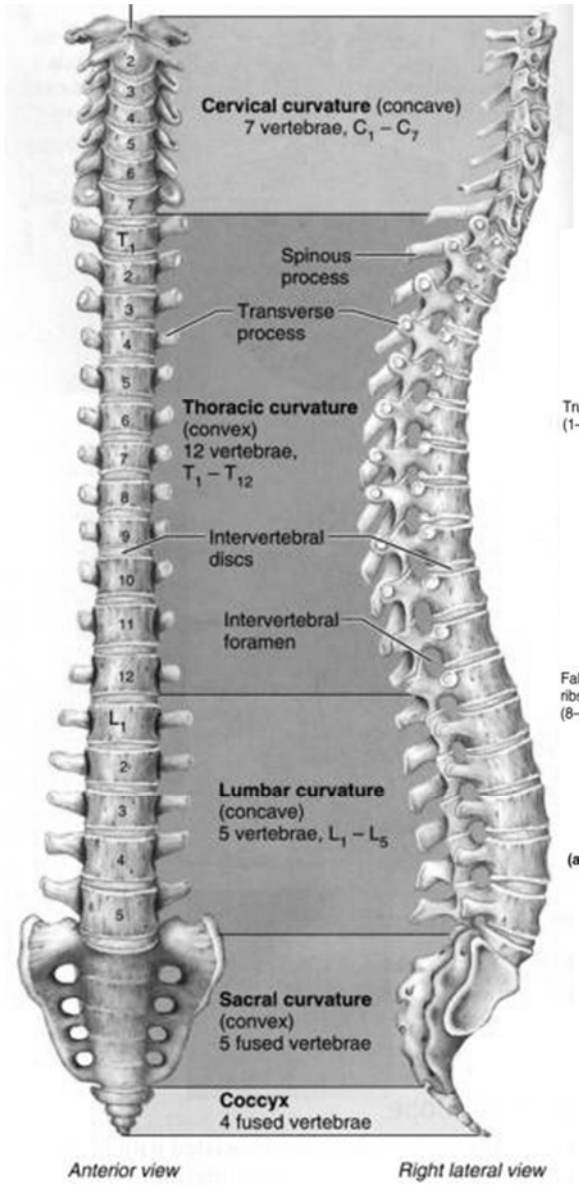


Fig. 7.13

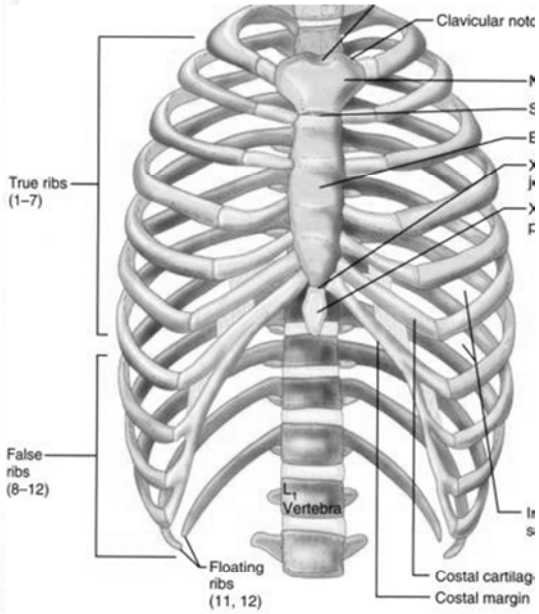
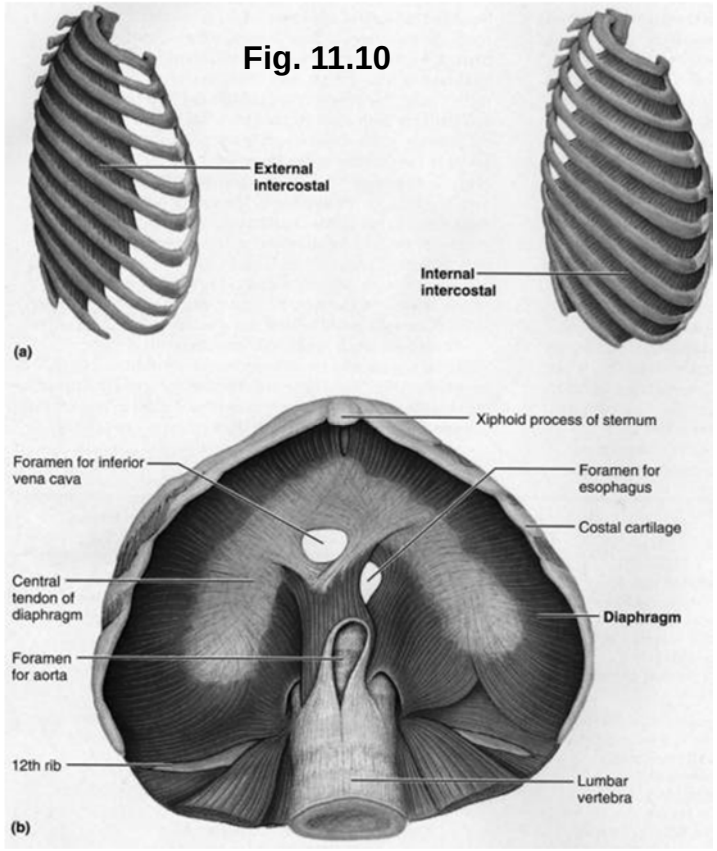


Fig. 7.19

Ribs

- ***Articulate with thoracic vertebrae (T1-T12)***
- ***1-10 connected to* Sternum *by cartilage***

Muscles of Breathing



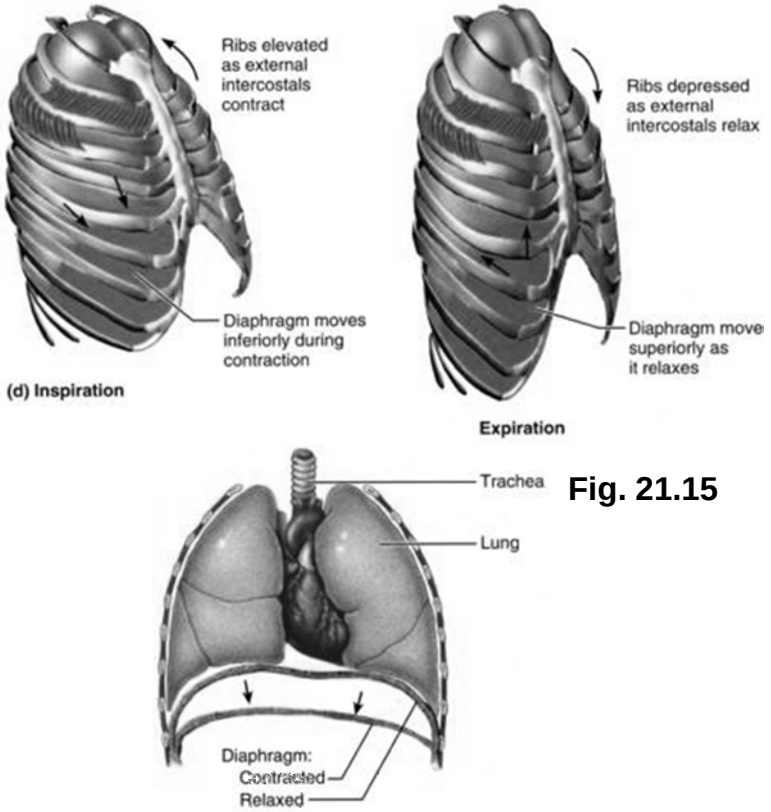


Fig. 21.15

Motor nerve innervation:

- ***Phrenic nerve*- from cervical spine (C3-C5) to diaphragm**
- ***Intercostal nerves*- from thoracic spine to intercostal muscles**

Thoracic Divisions

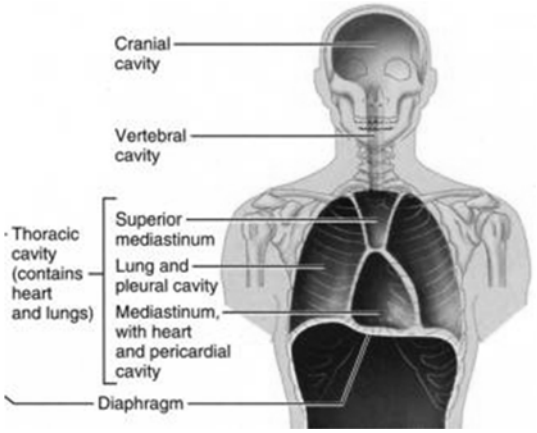


Fig. 1.8

Pleurae

- ***Double membrane (visceral, parietal) surrounding each lung***
- ***Couples lung to chest wall & diaphragm***

Mediastinum- all structures between the pleural cavities (heart, esophagus, trachea, blood vessels, nerves, thymus, etc.)

Lungs divided into 5 Lobes- 3 in right lung, 2 in left lung

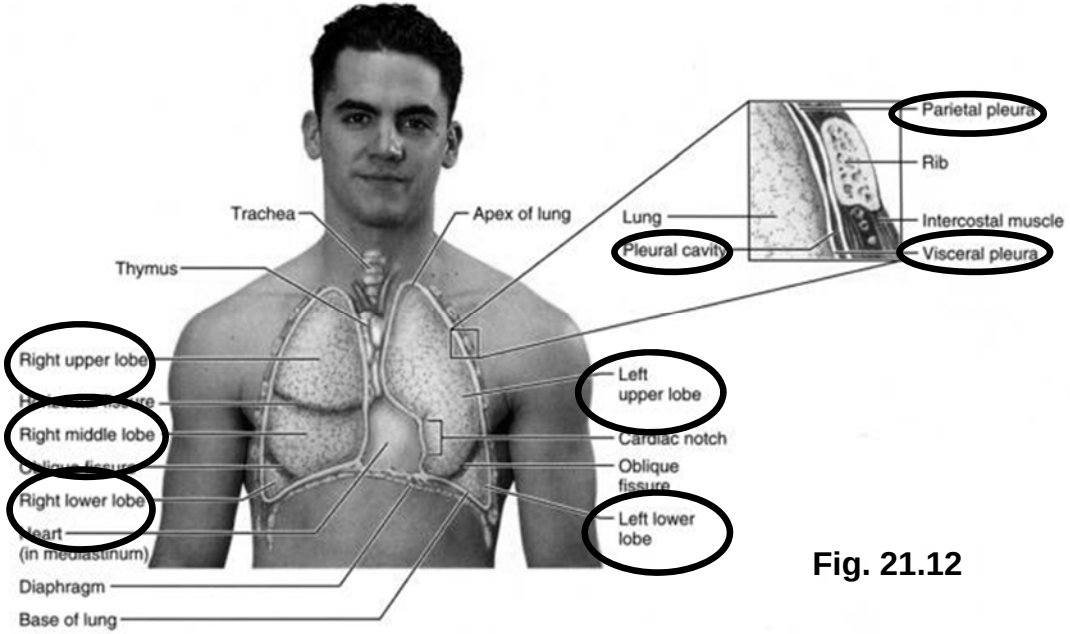


Fig. 21.12

Conducting Airways

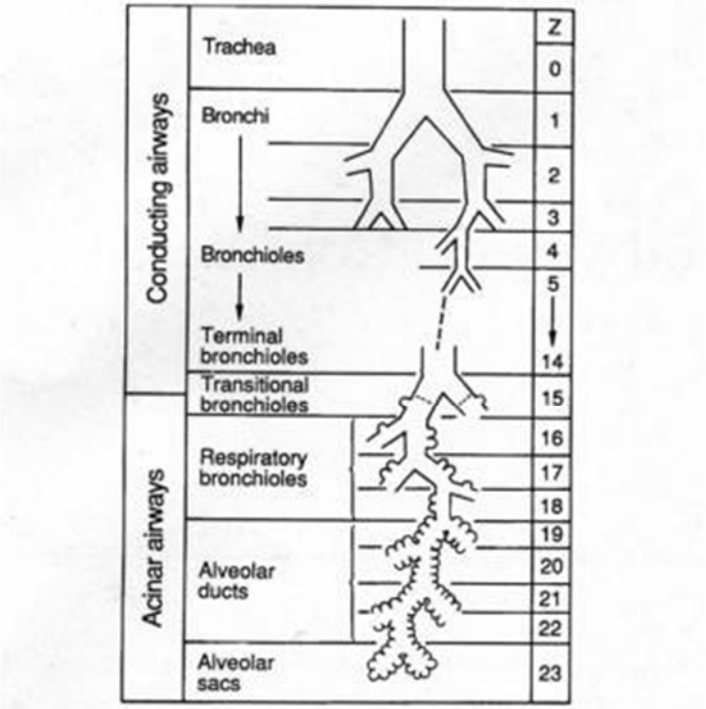
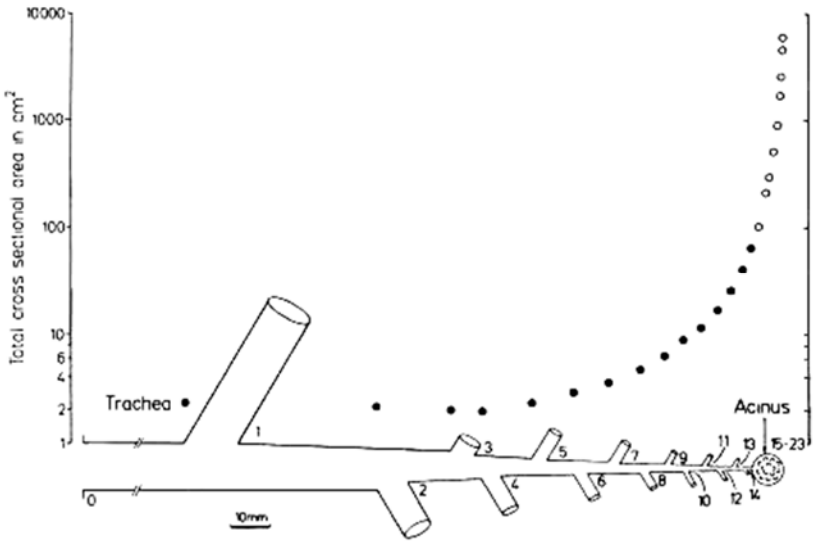


FIG. 1. Organization of airways in human lung, showing assignment to generations (z) of dichotomous branching in the symmetric typical path model. **(Weibel, 1963)**



Note huge increase in total cross-sectional area in final 10 generations, providing large surface area for gas-exchange

Racquetball Court
74 M^2

HOME • FACILITY HOURS: Nat - SERF - Shell - Nielsen - "Today" • FACILITIES • MEMBERSHIP • PROGRAMS • SEARCH

University of Wisconsin-Madison Division of

Recreational Sports

Natatorium/Unit II Gym

Nat Links:

Schedule
Cardio Center
Fitness Training Room
Gymnasiums
Locker Room
Merchandise
Parcourse
Racquetball Courts
Swimming Pool
Weight Room
Map of Facility
Parking & Directions
Nat Home

Program Links:

Aquatics
Club Sports
Group Fitness
Intramural Sports
Personal Training
Special Events
Symmetry

Facilities:

Nat
Nielsen Tennis Stadium
SERF
The Shell
Outdoor Areas

Racquetball Courts

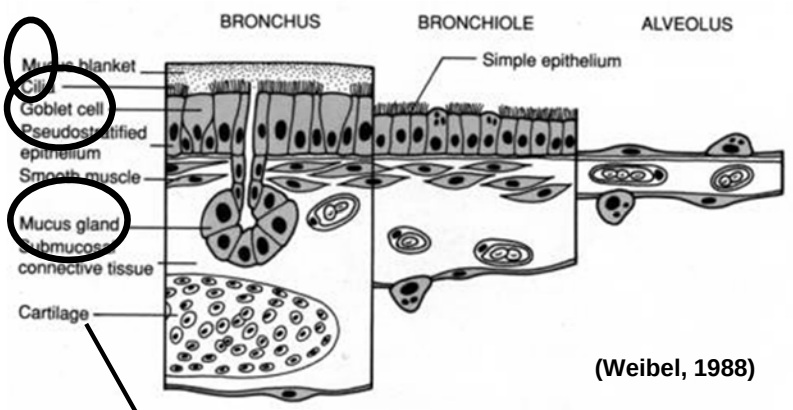
The lights in each court are on automatic sensors. Just walk into the court to turn them on! Check out racquetball racquets from the Towel Room or bring your own. Rec Sports does not provide racquetballs for check-out. Racquetballs can be purchased in the Program Office, room 1180.

Court 6 is the Challenge Court and is also fit for Walleyball. Check-out the Walleyball net and standards from the towel room with a valid ID card.

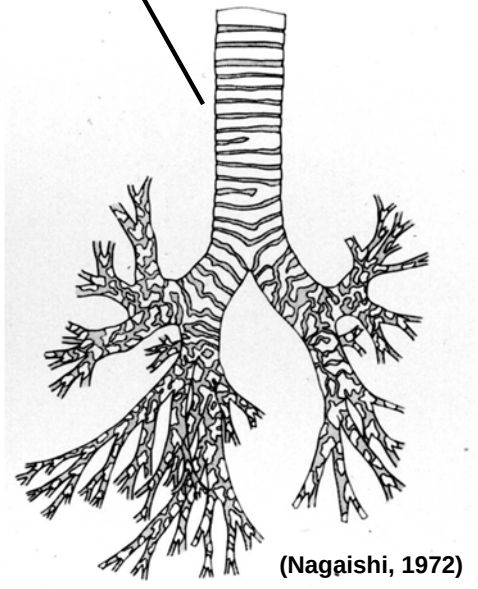
Reservation Policy

A reservation may be made up to three days in advance by stopping in the Nat Program Office, room 1180, or phoning (608) 262-3742. If a reservation is not secured 10 minutes after the hour, the reservation will be forfeited and available for reassignment.

Components of Airways

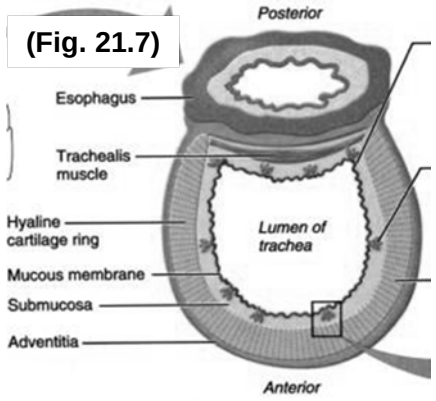


(Weibel, 1988)



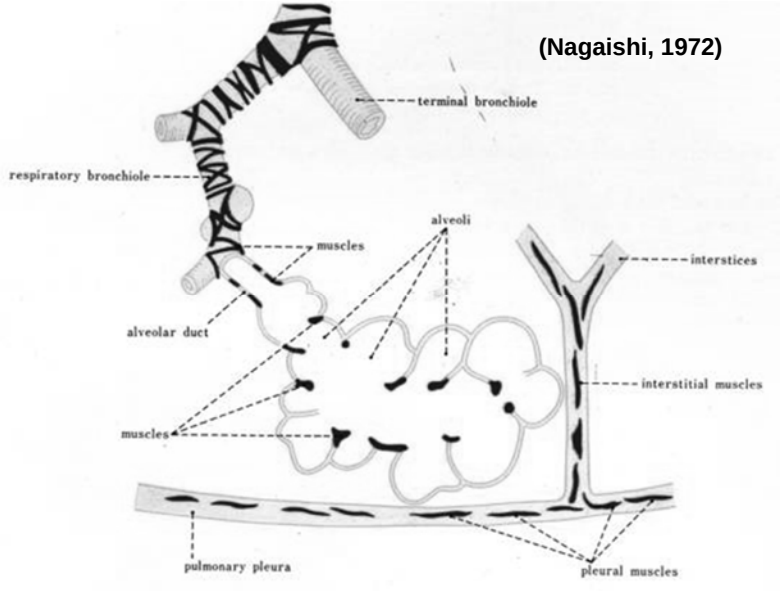
(Nagaishi, 1972)

(Fig. 21.7)

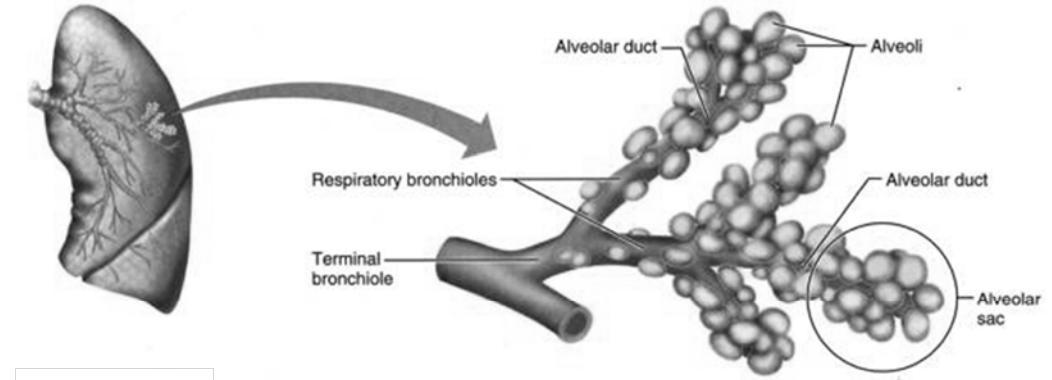


Distribution of airway smooth muscle

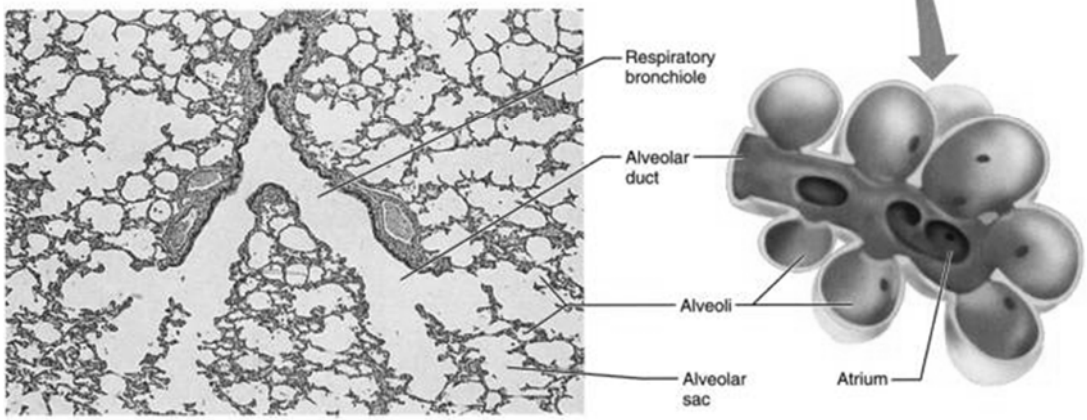
(Nagaishi, 1972)

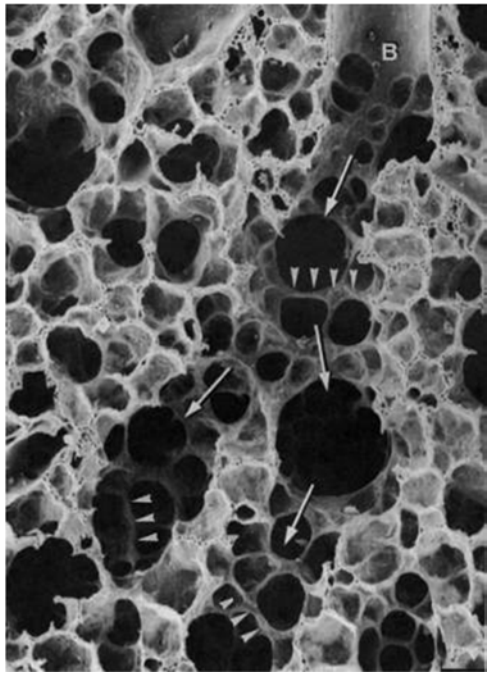


Gas Exchange Areas- Alveoli



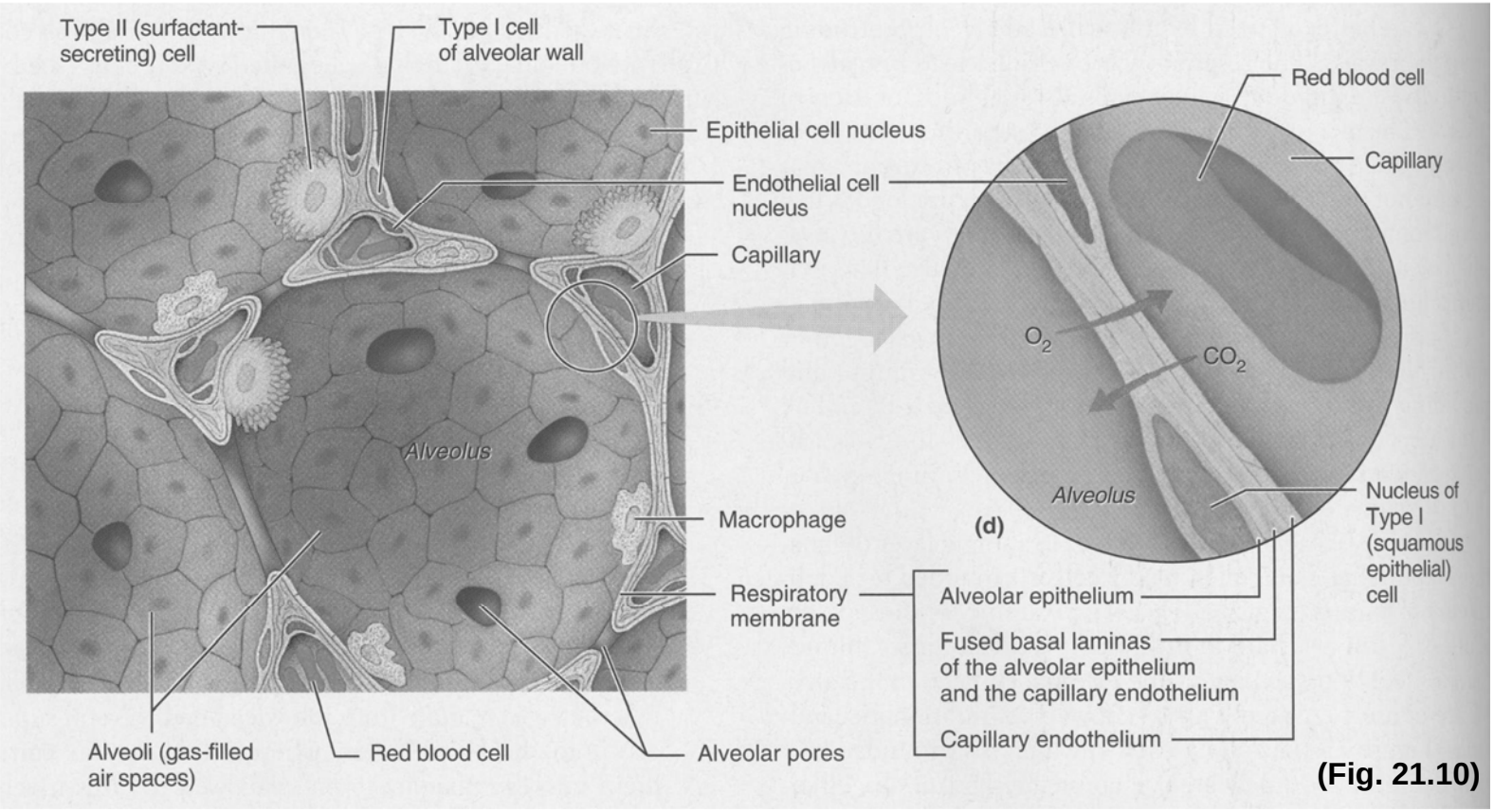
(Fig. 21.9)





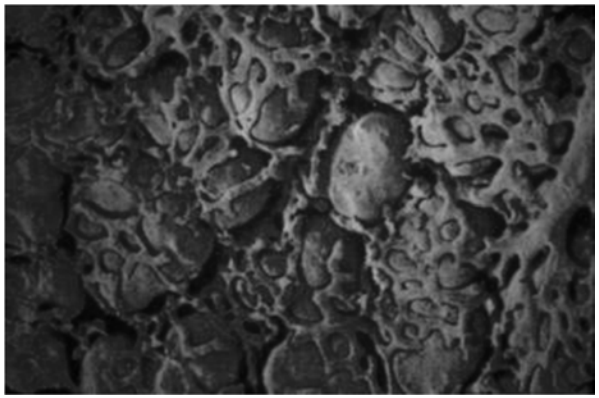
Weibel 1997

Structure of the Alveoli



(Fig. 21.10)

Gas Exchange Areas- Capillaries



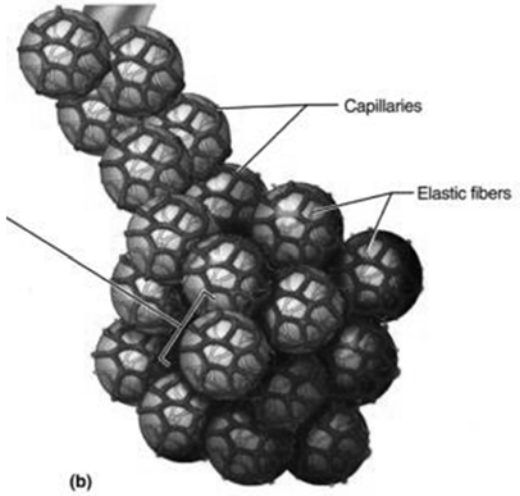
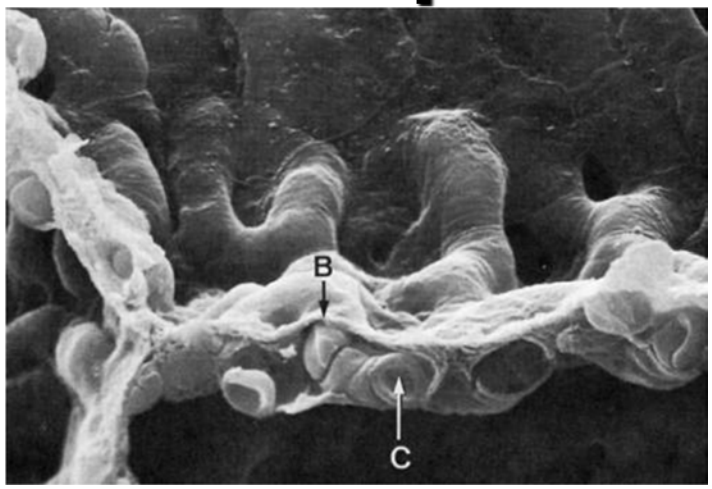
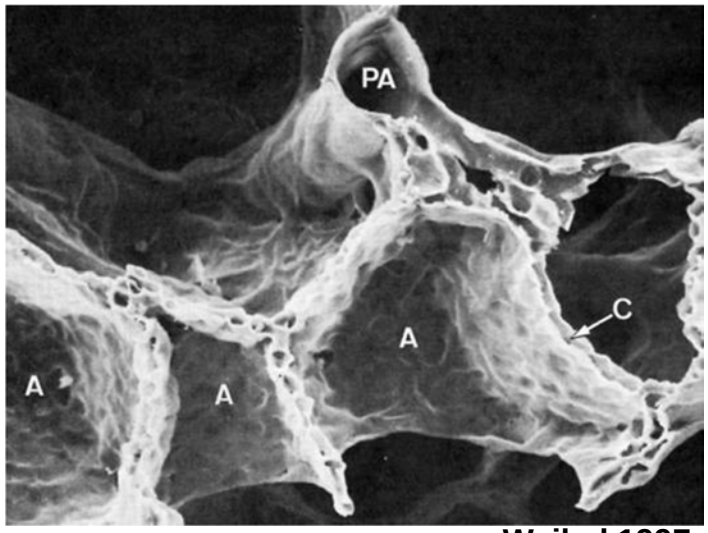


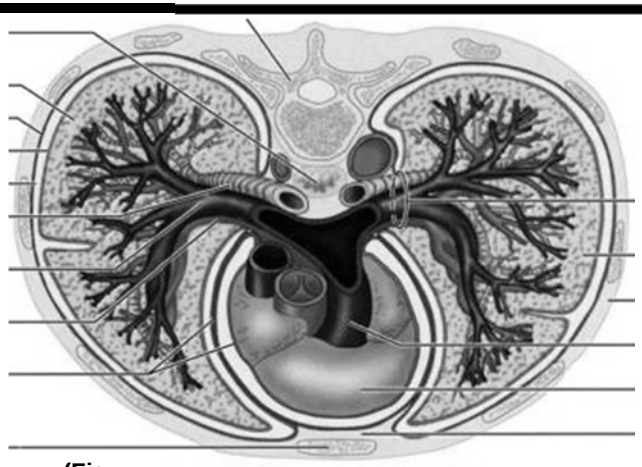
Fig. 21.10





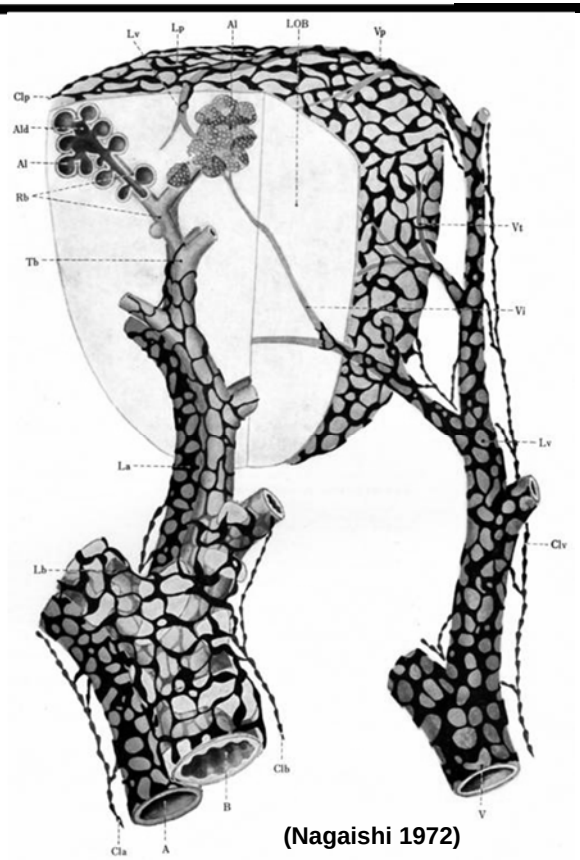
Weibel 1997

Pulmonary Circulation & Lymphatics



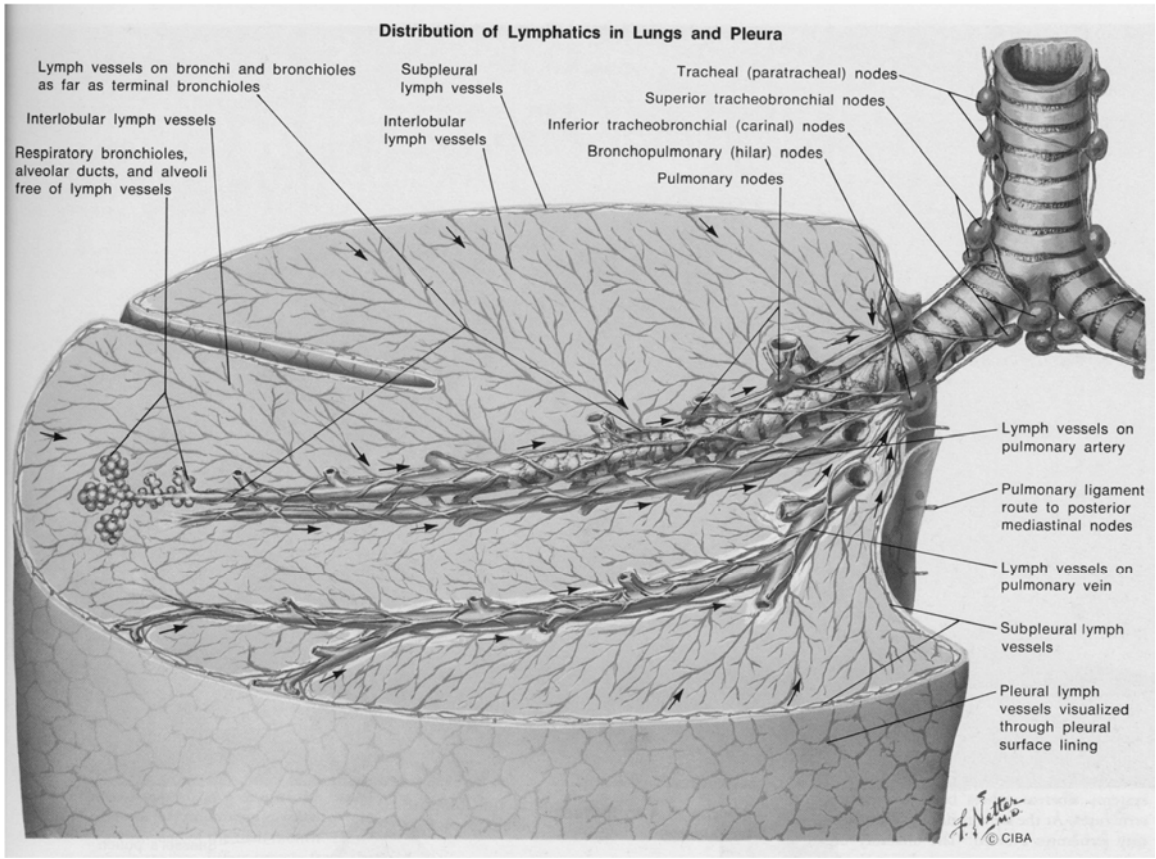
(Fig. 21.12)

- Pulmonary circulation is totally contained in thoracic cavity
- 100% of cardiac output flows thru Pulmonary Circulation
- Pulmonary arteries carry systemic venous blood to the gas exchange areas of the lung, and pulmonary veins carry oxygenated blood to the left atrium of the heart
- Pulmonary arteries branch in tandem with conducting airways
- A network of lymphatic vessels surrounds the conducting airways, pulmonary arteries and veins, and pleura



(Nagaishi 1972)

Lymphatics, cont'd



Bronchial Circulation

- **Walls of the conducting airways and pulmonary blood vessels receive blood supply via the bronchial circulation**
- **Bronchial circulation originates from branches from the thoracic aorta (*systemic* arteries)**
- **Bronchial veins from mediastinal bronchi and blood vessels empty into mediastinal branches of systemic veins**
- **Bronchial veins from intrapulmonary airways and blood vessels empty into the pulmonary vein**