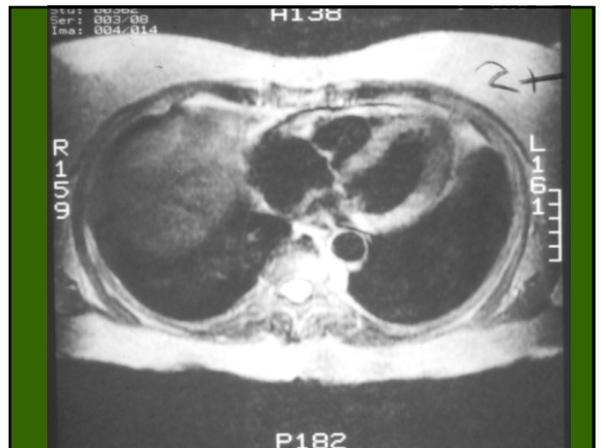
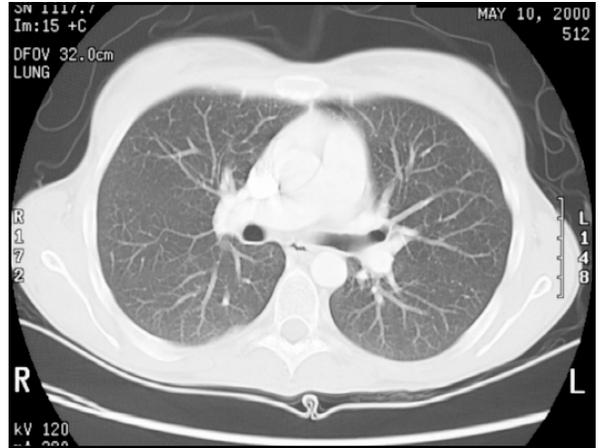


FUNDAMENTALS of THORACIC IMAGING

David S. Feigin MD
COL, MC, USA
Professor of Radiology
USUHS



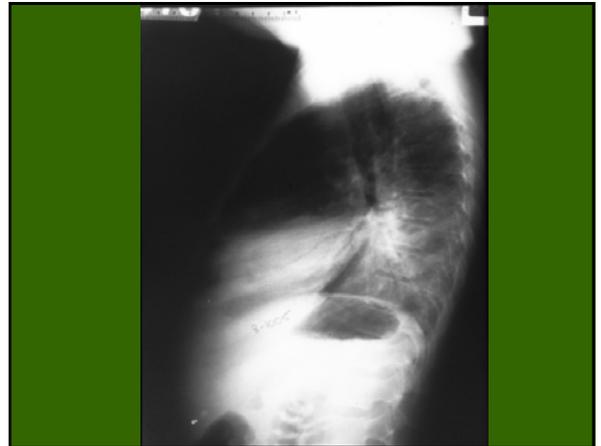
Terms Frequently Used and Misused

DENSITY - Whiteness, or any area of whiteness, on an image

LUCENCY - Blackness, or any area of blackness, on an image

SHADOW - Anything visible on an image; hence, any specific density or lucency

EDGE - Any visible demarcation between a density on one side and lucency on the other



Terms Frequently Used and Misused

LINE - A thin density with lucency on both sides or a thin lucency with density on both sides

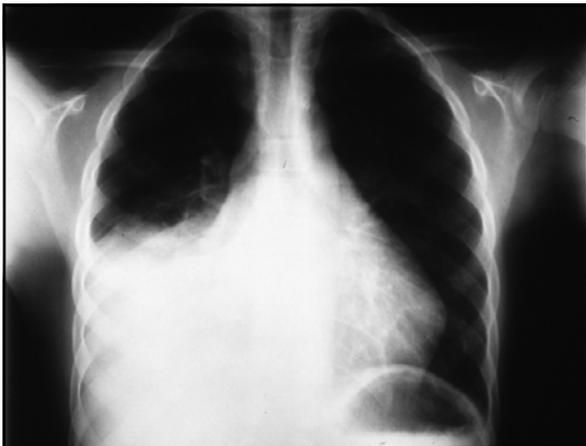
STRIPE - Either edge or line

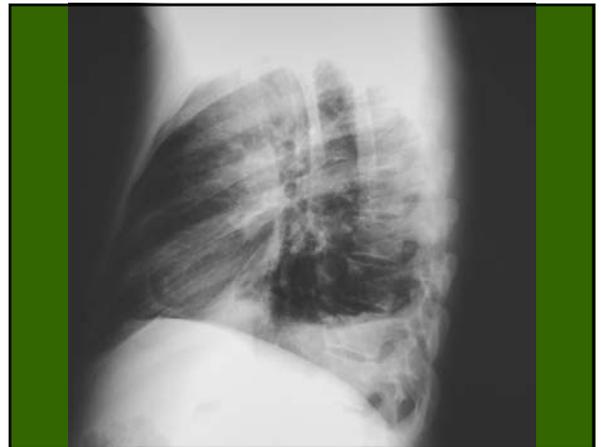
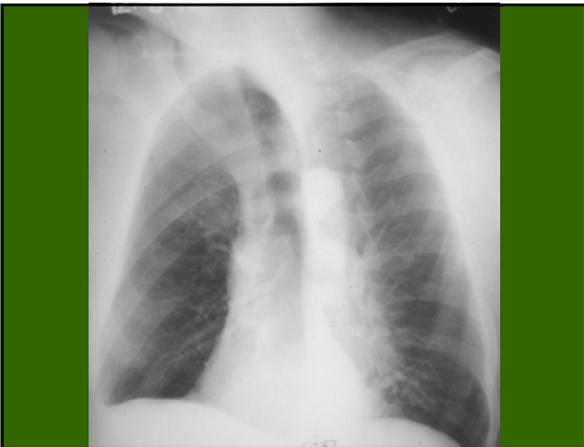
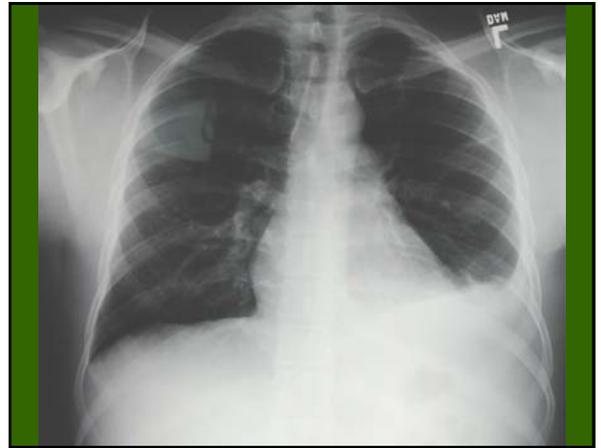
SILHOUETTE - Synonym for edge; the loss of an edge constitutes the "silhouette sign"

"The Rules of Visibility"

"Rule number 1"

The edge of any structure is only visible if it is bordered by a structure of different fundamental density





Rule #1

On a chest radiograph, the only fundamental densities are air, soft tissues (including fat and blood) and calcium.

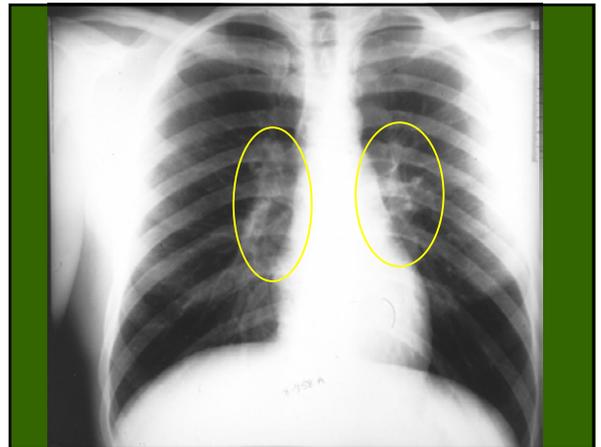
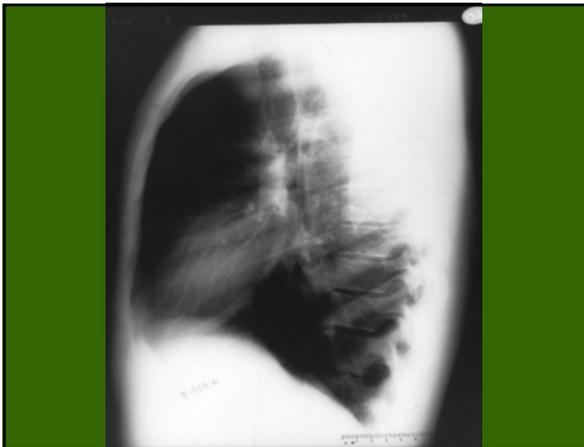
Rule number 1 is not altered by patient position, direction of x-ray beam, or by technique

Rule #2

The lightness and darkness of any part of the image is the result of all structures through which the x-ray beam has passed

Rule #2

Lightness and darkness are easily changed by technique, but the whole film will be similarly affected



Normal Lung

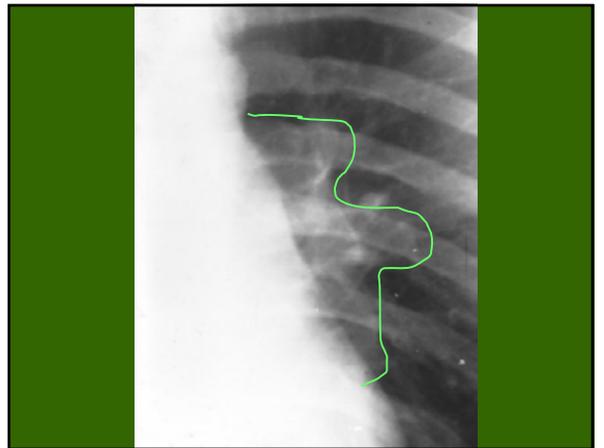
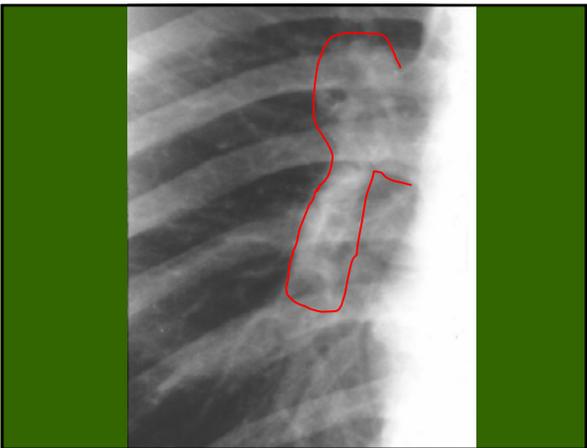
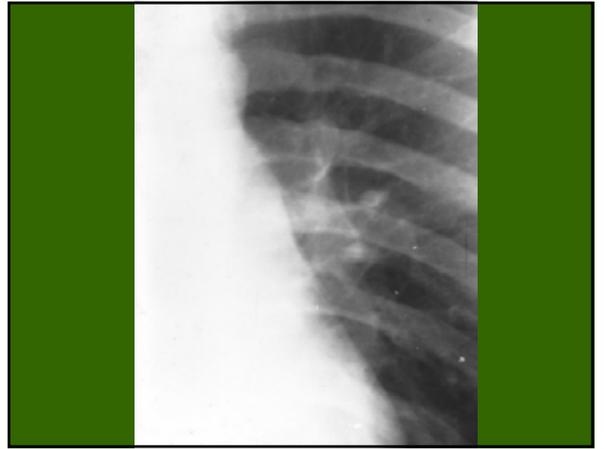
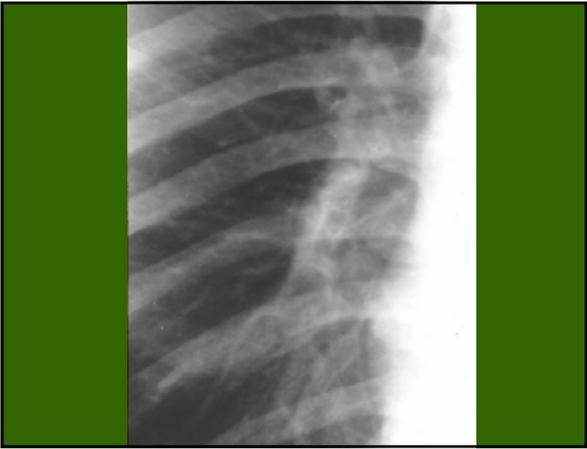
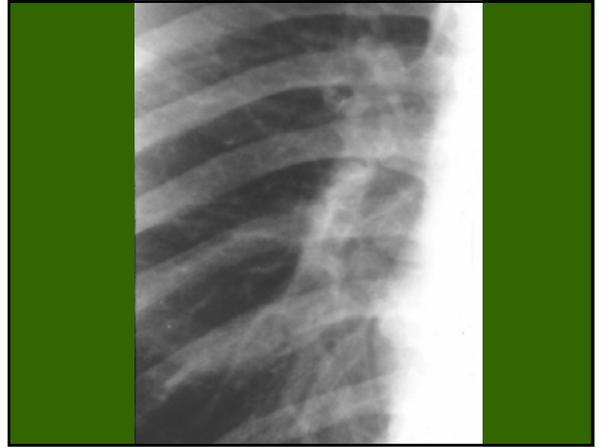
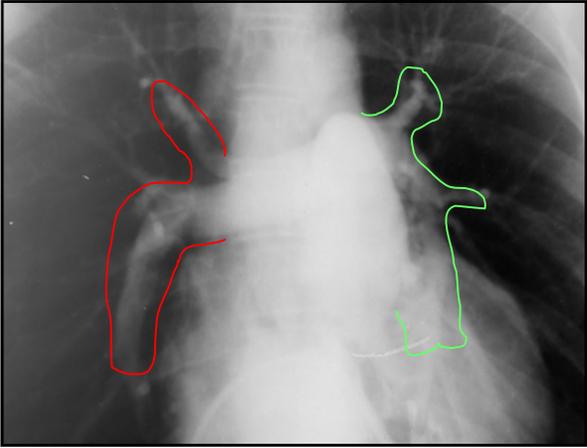
The Hilum

The hilum is the anatomic connection of the lung to mediastinum and therefore consists of a variety of vessels, bronchi, and lymph nodes

The visible portion of each normal hilum is the right or left pulmonary artery

The pulmonary veins are inferior and posterior to the arteries

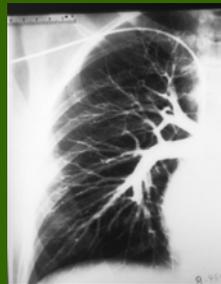






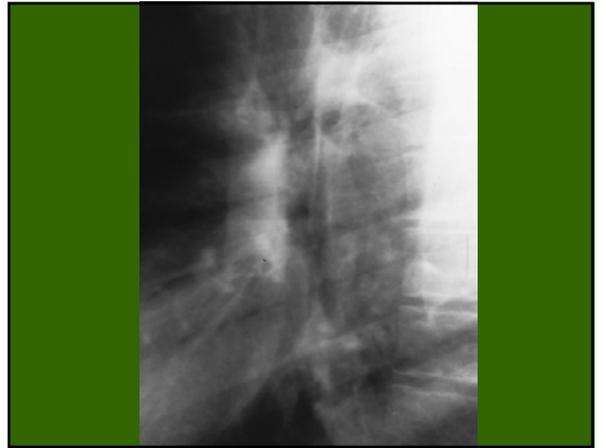
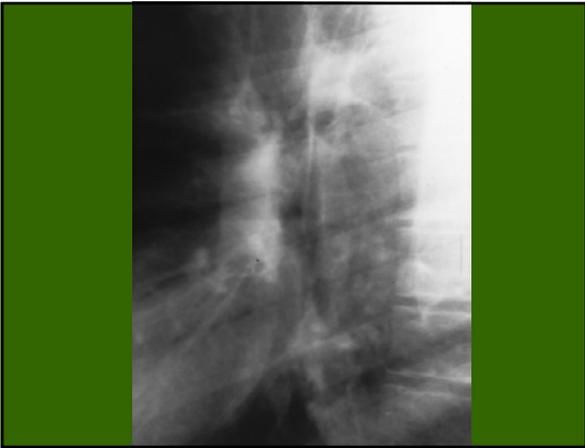
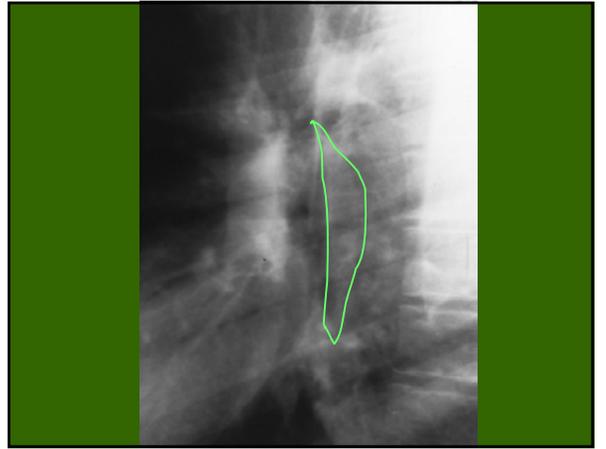
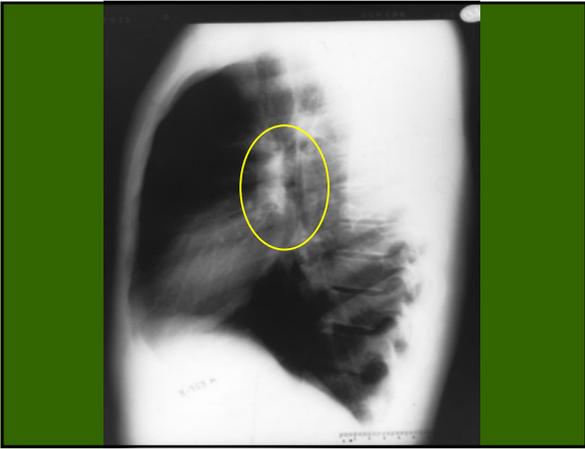
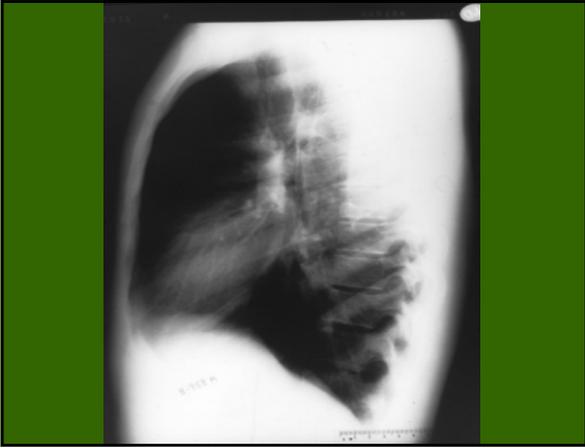
Normal Lung - Hilum

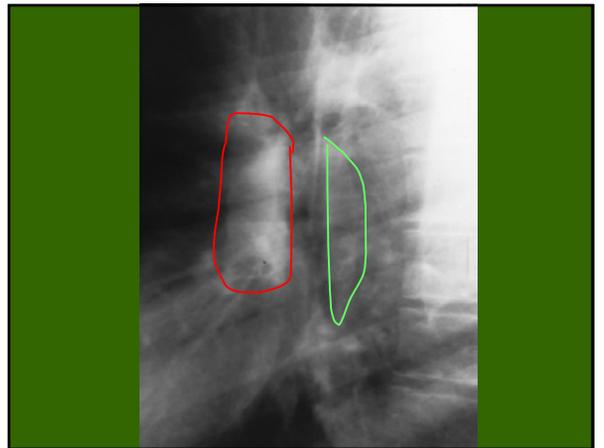
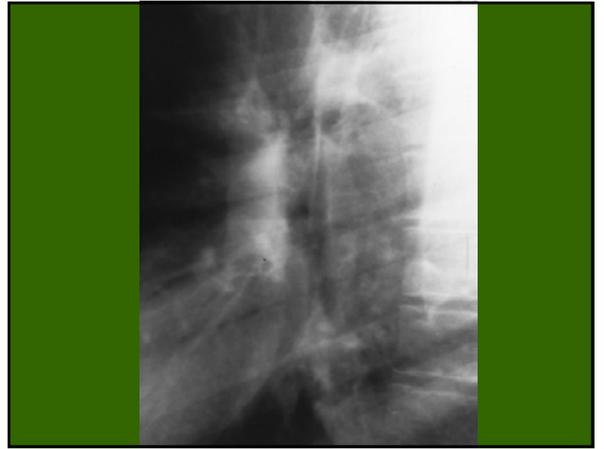
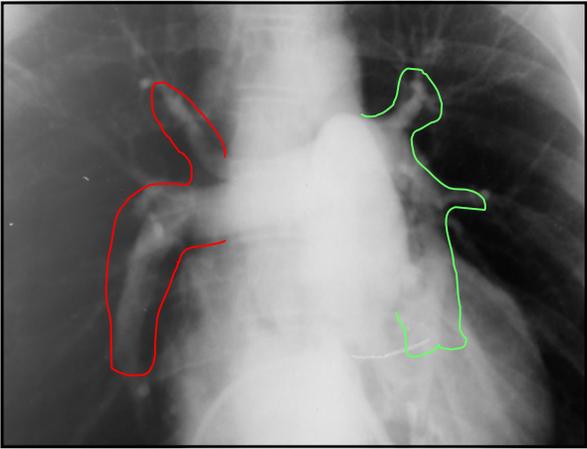
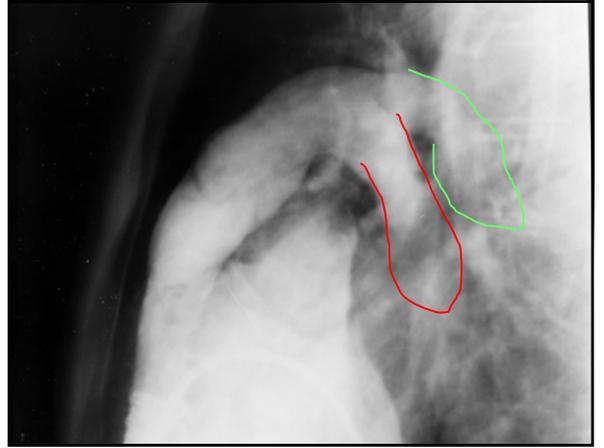
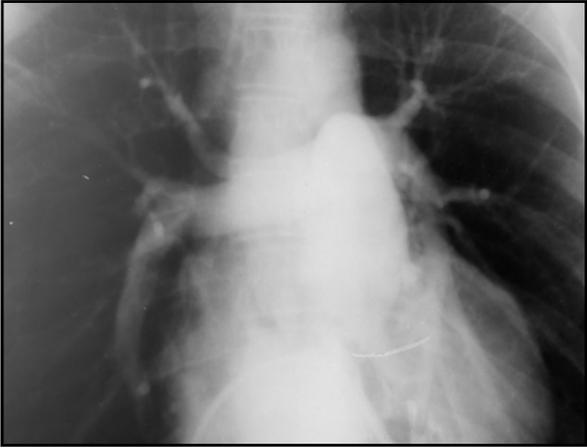
- The pulmonary veins are inferior and posterior to the pulmonary arteries
 - Located behind the edges of the heart on the frontal view
 - Overlapping many other structures on the lateral view
 - The major bronchi are visible as lucencies
 - The lymph nodes are too small to be visible when normal



Normal Lung - Hilum

- The right and left pulmonary arteries are clearly visible on the lateral view, in the center of the image
- The right pulmonary artery is just anterior to the air column (trachea continuous with main bronchi) and left pulmonary artery is just posterior



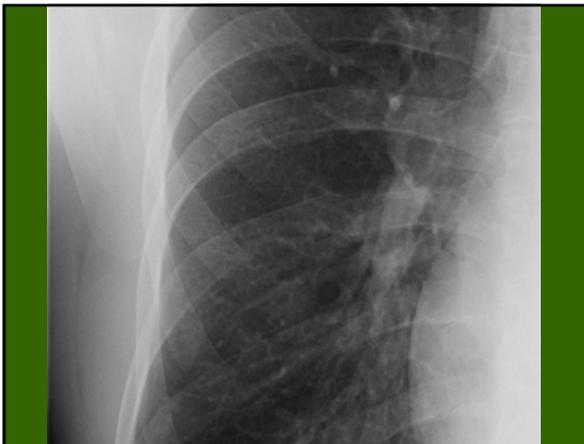
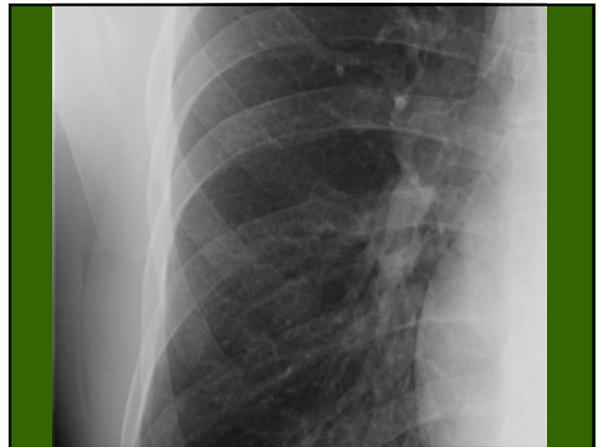
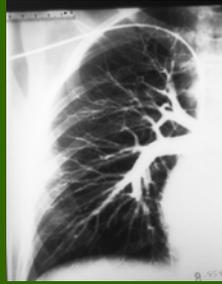


Normal Lung Markings

The only normal densities within the lungs are the pulmonary vessels when filled with blood

The normal markings (vessels) can always be followed from the hilum toward the lung periphery in all directions

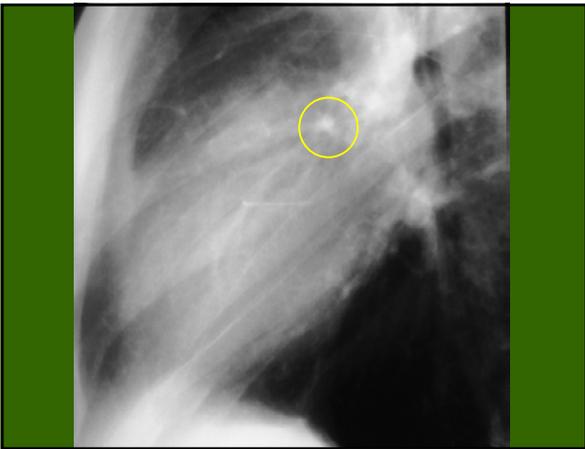
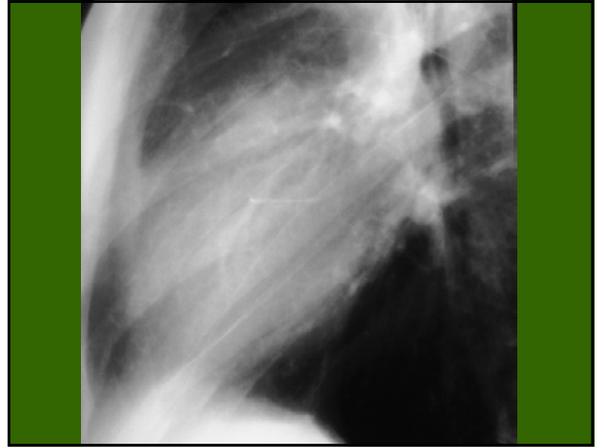
They branch at acute angles, taper and diverge toward the periphery



Normal Lung Markings

Markings on end appear as small masses or nodules

They are recognized as normal vessels by the fact that they are superimposed upon vessels of the same diameter branching in other directions



Normal Lung Markings

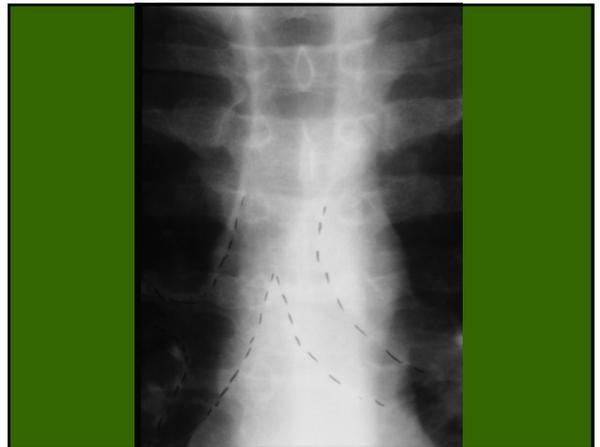
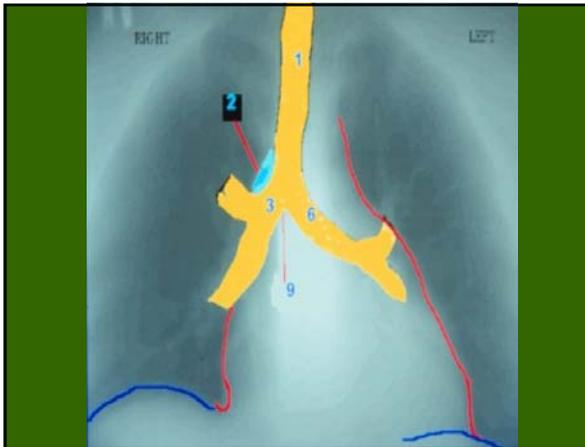
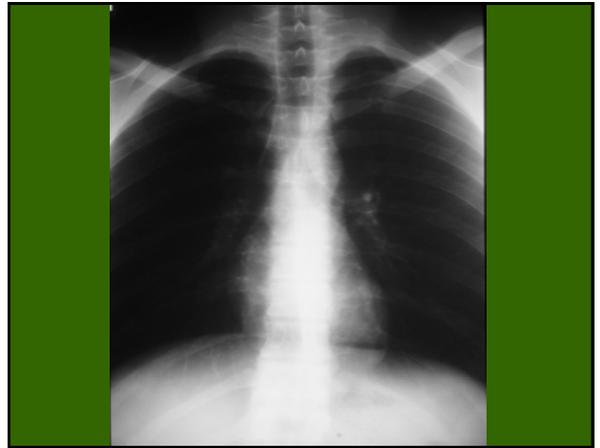
Abnormal pulmonary markings are all shadows in addition to the normal markings

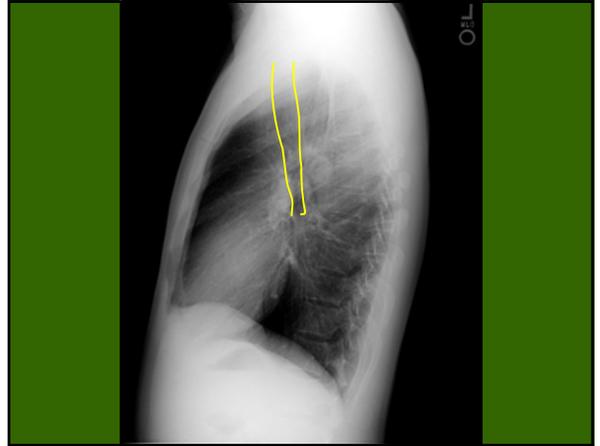
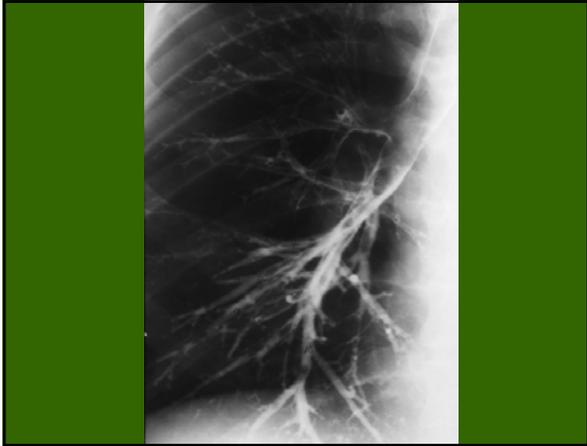
Many such shadows obscure the normal markings or displace them



The Airway

- The trachea is visible on both frontal and lateral views because it satisfies Rule #1
- The main bronchi are visible within the mediastinum and the medial portion of the hilum
- Once a bronchus is surrounded by air-filled alveoli, it becomes invisible because nearly all normal bronchial walls are too thin to be visible lines



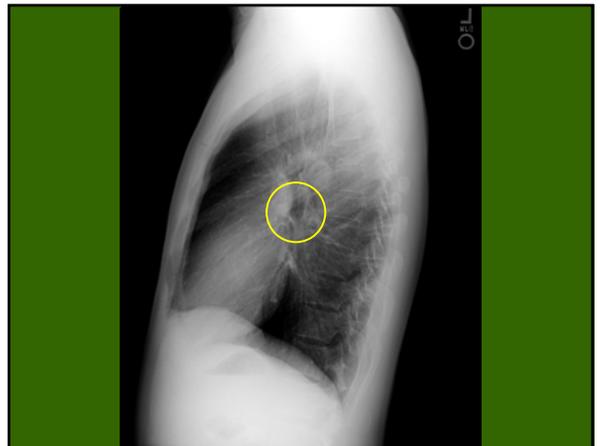
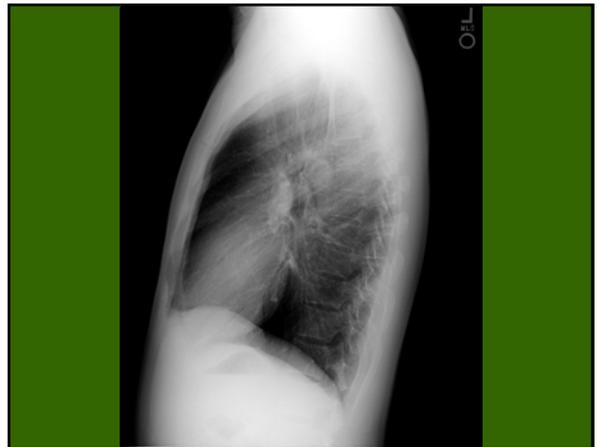


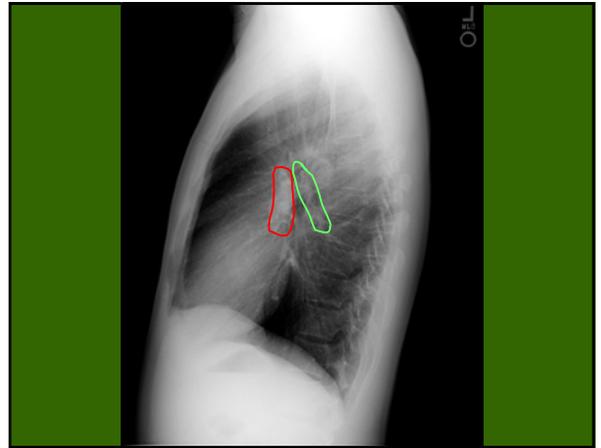
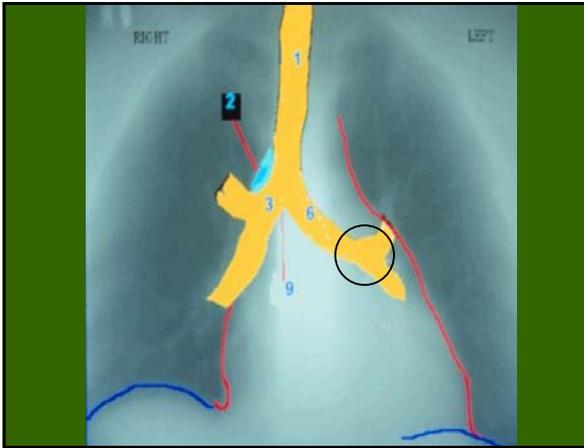
Demystifying the Lateral View

The air column, which includes the trachea and largest bronchi, is visible because it satisfies Rule Number 1

The carina is not visible on the lateral view because the main bronchi continue in the same direction as the trachea

The round lucency in the center of the lateral view is the distal portion of the left main bronchus as it becomes horizontal





Demystifying Lateral View

The lateral view of the hila surrounds the left bronchial lucency

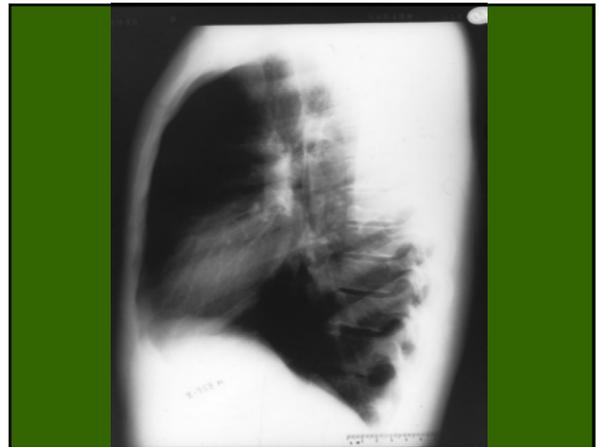
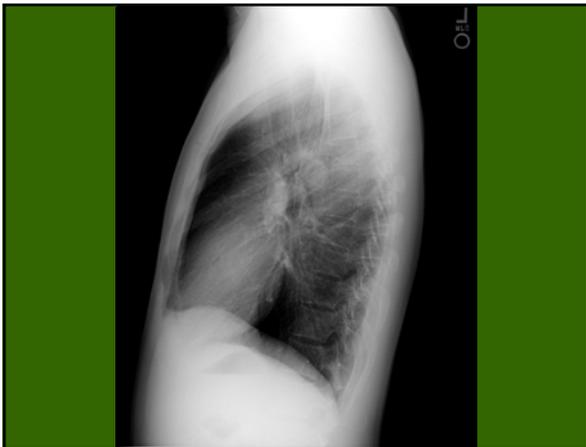
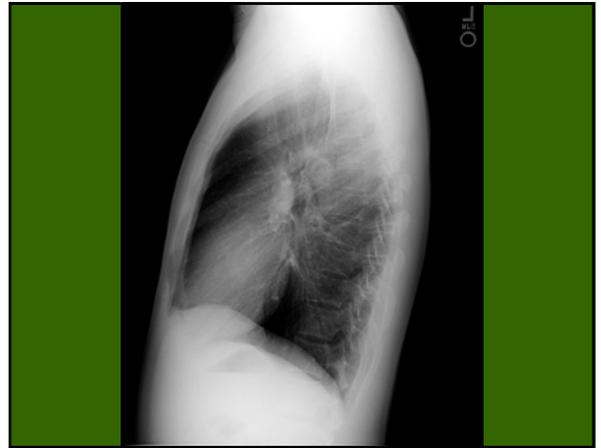
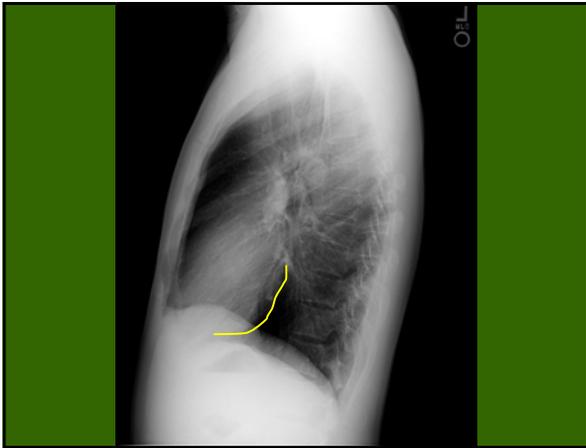
Demystifying Lateral View

The heart shadow

The only margin of the heart that is visible as a distinct edge is the back of the left ventricle, which satisfies Rule #1 by bordering the left lower lobe of the lung

The top of the heart shadow is never a distinct edge because the pulmonary artery and aorta, rather than lung, are directly above the heart





Demystifying Lateral View

The relative lucency above the heart shadow is caused by the relative thinness of the mediastinum in that region

It is thus an example of Rule number 2 and does not have distinct margins

The thoracic spine always appears increasingly lucent from top to bottom, until it crosses the diaphragms. This is another manifestation of Rule number 2

