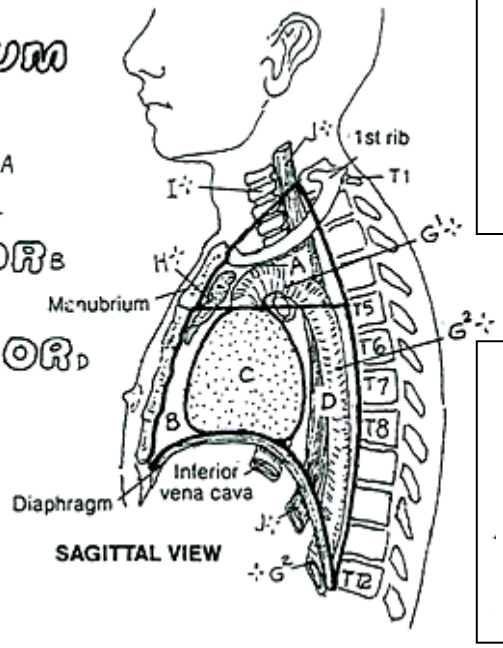
MEDIASTINUM, WALLS & COVERINGS OF THE HEART

MEDIASTINUM

REGIONS:

- SUPERIOR A
- INFERIOR:
  - ANTERIOR B
  - MIDDLE C
  - POSTERIOR D



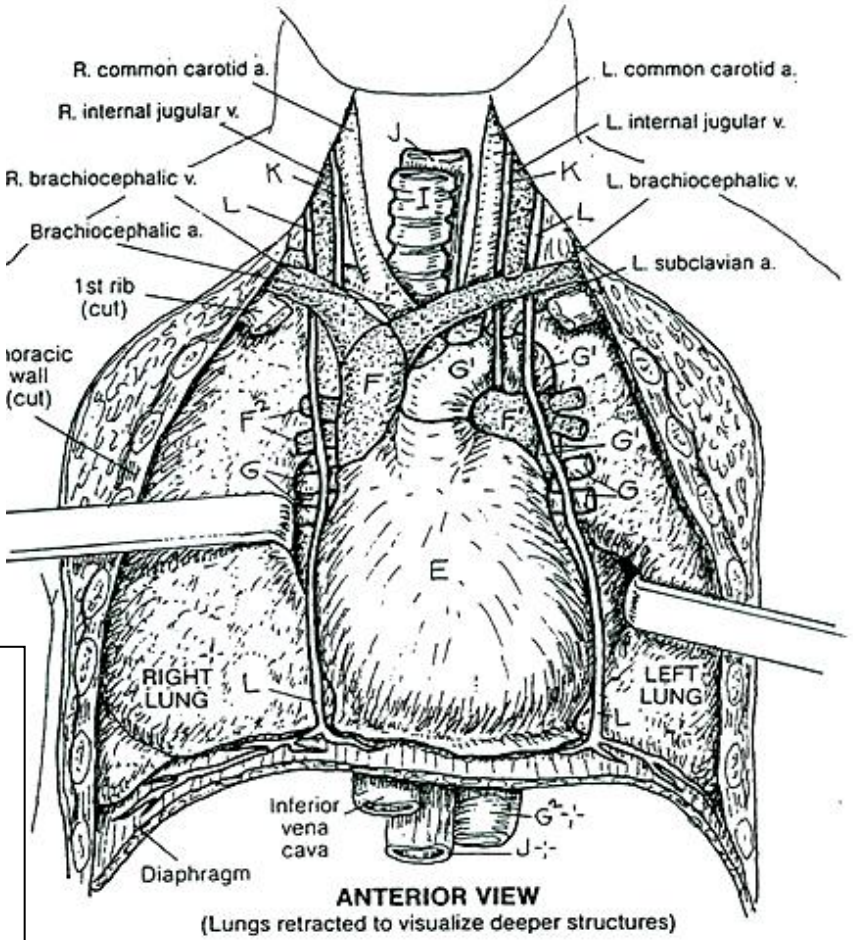
SAGITTAL VIEW

CN: Use blue for F, red for G, and your lightest colors for A–D. (1) Begin with the regions of the mediastinum at upper left and color over all the structures within the dark outline. (2) Color the major structures within the mediastinum in the anterior view. Note that the lungs, not being in the mediastinum, remain uncolored. Note that the thymus, which can be seen in the sagittal view, has been deleted here to show the great vessels covered by it. (3) Finally, color the walls of the heart and layers of pericardium at lower left. The pericardial cavity has been greatly exaggerated for coloring. It is normally only a potential space.

The mediastinum (median septum or partition) is a highly populated region between and excluding the lungs. A variety of passageways, nerves, and vessels enter, pass through, and exit the mediastinum. For descriptive purposes, the mediastinum is divided into the subdivisions (regions) illustrated. The *superior mediastinum* is remarkable for the array of *great vessels of the heart* and the *trachea*, *esophagus*, and *vagus* and *phrenic nerves*. At the level of the T4–T5 vertebrae (superior/inferior mediastinal border), the trachea bifurcates into the main bronchi (see Plate 133) posterior to the great vessels, and the *aorta* makes its *arch*. The *posterior mediastinum* includes the inferior continuation of the esophagus embraced by a fine network of vagal nerve fibers, the thoracic duct (see Plate 121), and the descending (*thoracic*) aorta. The floor of the mediastinum is the diaphragm, penetrated by the thoracic aorta, esophagus, and inferior vena cava.

STRUCTURES:

- PERICARDIUM-LINED HEART E
- GREAT VESSELS:
  - SUPERIOR VENA CAVA F
  - PULMONARY TRUNK F¹
  - PULMONARY ARTERY F²
  - PULMONARY VEIN G
  - AORTIC ARCH G¹
  - THORACIC AORTA G²
- THYMUS H
- TRACHEA I
- ESOPHAGUS J
- VAGUS NERVE K
- PHRENIC NERVE L



ANTERIOR VIEW
(Lungs retracted to visualize deeper structures)

The heart wall consists of an inner layer of simple squamous epithelium (*endocardium*) overlying a variably thick *myocardium* (cardiac muscle). External to the myocardium is a three-layered sac (*pericardium*). The innermost layer of this sac is the *visceral pericardium* (epicardium), clothing the heart. At the origin of the aortic arch, this layer turns (reflects) outward to become the *parietal pericardium* (imagine a fist clutching the edges around the opening of a paper bag; now push the fist into the closed bag still clutching the edges; as you do so, note that your fist becomes surrounded by two layers of the paper bag, yet is not inside the bag itself). The relationship of your fist to the two layers of the bag is the relationship of the heart to the visceral and parietal pericardium. The cavity of the bag is empty—the fist is not in the bag (if you did it right!). Similarly, the *pericardial cavity* between the two pericardial layers is empty as well, except for serous fluid that makes for friction-free movement of the heart in its sac.

The fibrous pericardium is the outer surface of the parietal pericardium; it is fibrous and fatty and is strongly attached to the sternum, the great vessels, and the diaphragm. It keeps the twisting, contracting, squeezing heart within the middle mediastinum.

CHAMBERS OF THE HEART

CN: Use blue for A–A^4, red for H–H^4, and your lightest colors for B, C, I, and J. All dotted arrows (A^4) receive a blue color; all clear arrows (H^4) receive a red color. (1) Begin with the arrows A^4 above the title list and above the superior vena cava (A) in the illustration at upper right and color the structures in the order of the title list (A–H^3). (2) Color the circulation chart at lower right, beginning with the arrow A^4 leading into the right atrium (numeral 1). Color the numerals in order from 1 to 4 and related arrows. Do not color the chambers or the vessels in this drawing at lower right.

→ A^4

SUPERIOR VENA CAVA A
INFERIOR VENA CAVA A'
RIGHT ATRIUM B

RIGHT VENTRICLE C
A-V TRICUSPID VALVE D
CHORDAE TENDINEAE E
PAPILLARY MUSCLE F

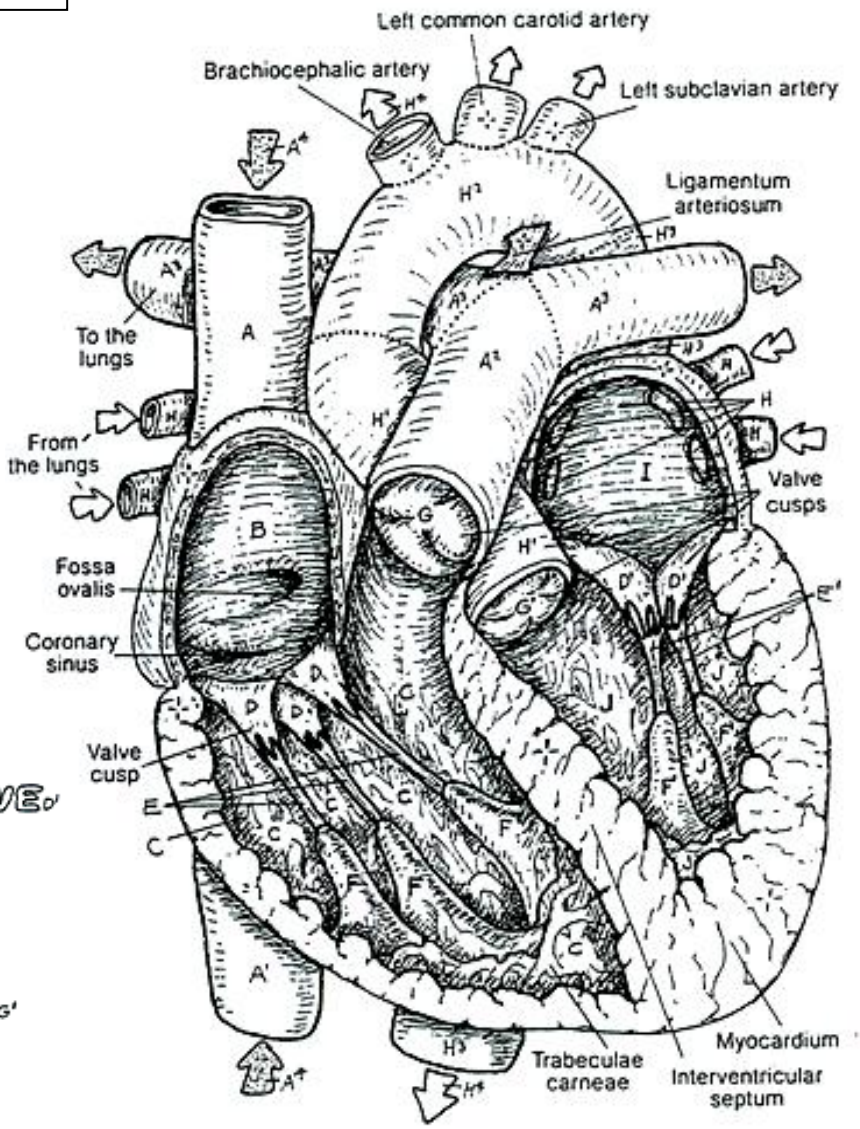
PULMONARY TRUNK A^2
PUL. SEMILUNAR VALVE G
PUL. ARTERY A^3

← H^4
PULMONARY VEIN H
LEFT ATRIUM I

LEFT VENTRICLE J
A-V BICUSPID (MITRAL) VALVE D'
CHORDAE TENDINEAE E'
PAPILLARY MUSCLE F'

ASCENDING AORTA H'
AORTIC SEMILUNAR VALVE G'
AORTIC ARCH H^2
THORACIC AORTA H^3

ANTERIOR VIEW OF HEART CAVITIES AND GREAT VESSELS



The heart is the muscular pump of the blood vascular system. It contains four cavities (chambers): two on the right side (pulmonary heart), two on the left (systemic heart). The pulmonary "heart" includes the right atrium and right ventricle. The thin-walled *right atrium* receives poorly *oxygenated blood* from the *superior* and the *inferior vena cava* and from the coronary sinus (draining the heart vessels). The thin-walled *left atrium* receives richly *oxygenated blood* from pulmonary veins. Atrial blood is pumped at a pressure of about 5 mm Hg into the *right and left ventricles* simultaneously through the atrioventricular orifices, guarded by the 3-cusp *tricuspid valve* on the right and the 2-cusp *bicuspid valve* on the left. The cusps are like panels of a parachute, secured to the *papillary muscles* in the ventricles by tendinous *chordae tendineae*. These muscles contract with the ventricular muscles, tensing the cords and resisting cusp over-flap as ventricular blood bulges into them during ventricular contraction (systole). The right ventricle pumps oxygen-deficient blood to the lungs via the *pulmonary trunk* at a pressure of about 25 mm Hg (right ventricle), and the left ventricle pumps oxygen-rich blood into the *ascending aorta* at a pressure of about 120 mm Hg simultaneously. This pressure difference is reflected in the thicker walls of the left ventricle compared to the right. The pocket-like *pulmonary and aortic semilunar valves* guard the trunk and aorta, respectively. As blood falls back toward the ventricle from the trunk/aorta during the resting phase (diastole), these pockets fill, closing off their respective orifices and preventing reflux into the ventricles.

SCHEME OF BLOOD CIRCULATION

CN: Use blue for A, purple for B, red for C, and very light colors for D and E. (1) Color the titles for systemic and pulmonary circulation, the two figures, and the borders bracketing the large illustration. Also color purple (representing the transitional state between oxygenation and deoxygenation) the two capillaries, demonstrating the difference between capillary function in the lungs and that in the body. (2) Begin in the right atrium of the heart and color the flow of oxygen-poor blood (A) into the lungs. After coloring the pulmonary capillary network (B), color the oxygen-rich blood (C) that re-enters the heart and is pumped into and through the systemic circuit.

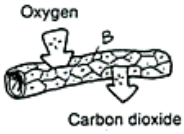
OXYGEN-POOR BLOOD A

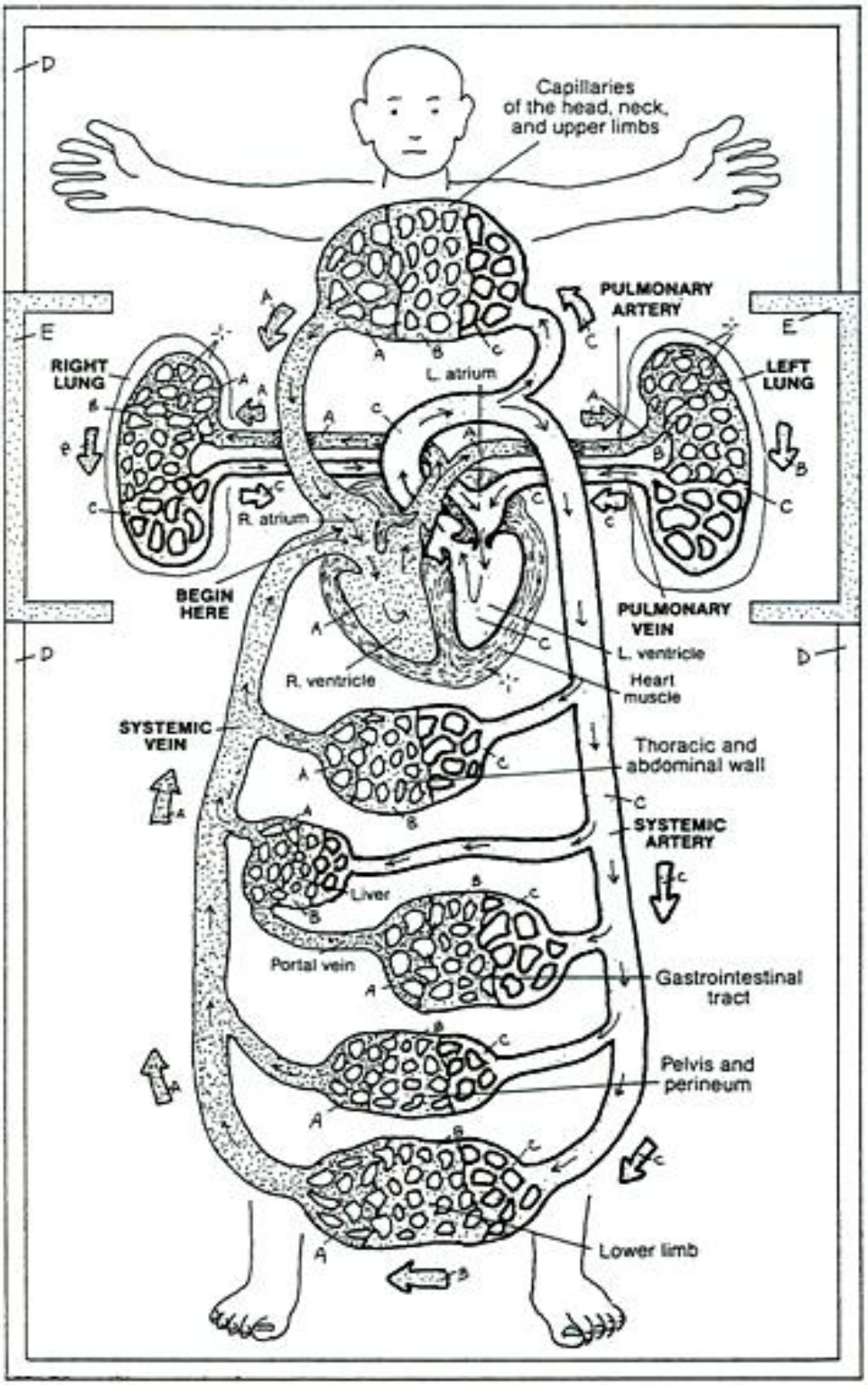
CAPILLARY BLOOD B

OXYGEN-RICH BLOOD C

SYSTEMIC CIRCULATION D

PULMONARY CIRCULATION E





Circulation of blood begins with the heart, which pumps blood into arteries and receives blood from veins. *Arteries* conduct blood *away* from the heart regardless of the amount of oxygen (oxygenation) in that blood. *Veins* conduct blood toward the heart, regardless of the degree of oxygenation of the blood. *Capillaries* are networks of extremely thin-walled vessels throughout the body tissues that permit the exchange of gases and nutrients between the vessel interior (vascular space) and the area external to the vessel (extracellular space). Capillaries receive blood from small arteries and conduct blood to small veins.

There are two circuits of blood flow: (1) the pulmonary circuit, which conveys blood from the right side of the heart to the lungs and fresh blood back to the left side of the heart, and (2) the systemic circuit, which conveys blood from the left heart to the body tissues and returns blood to the right heart. The color red is used universally for *oxygenated blood*, and the color blue is used for *oxygen-poor blood*.

Clearly, not all arterial blood is fully oxygenated (in the pulmonary circulation, arteries conduct poorly oxygenated blood to the lungs), and not all venous blood is oxygen deficient (pulmonary veins conduct oxygenated blood to the heart).

Capillary blood is mixed; it is largely oxygenated on the arterial side of the capillary bed, and it is largely deoxygenated on the venous side, as a consequence of delivering oxygen to and picking up carbon dioxide from the tissues it supplies.

One capillary network generally exists between an artery and a vein. There are exceptions: the portal circulation of the liver involves two sets of capillaries between artery and vein (Plate 119); the hypophyseal portal system involves two capillary networks between artery and vein (Plate 152); and the renal vascular system has a glomerulus and a peritubular capillary plexus between artery and vein (Plate 150).