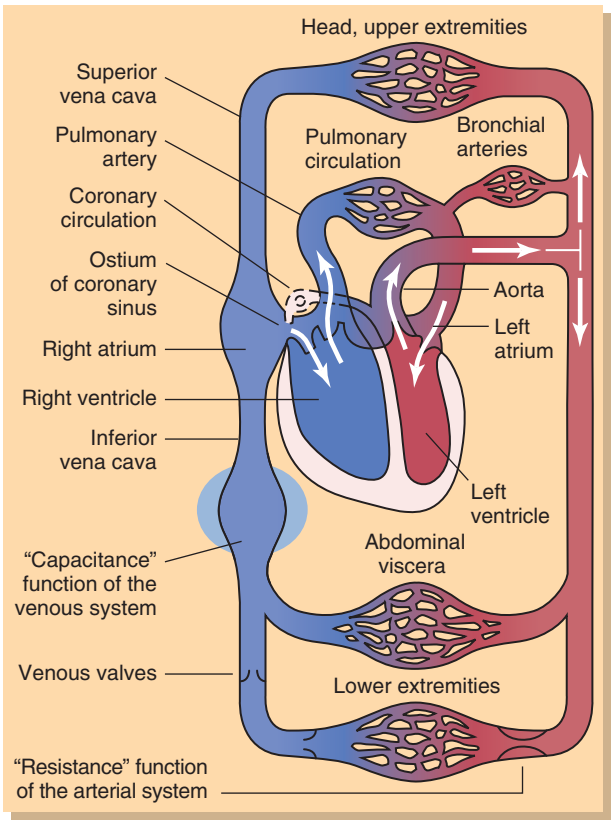

FIGURE 2-1 **A,** Schematic representation of the systemic and pulmonary circulatory systems. The venous system contains the greatest amount of blood at any one time and is highly distensible, accommodating a wide range of blood volumes (high capacitance). The arterial system is composed of the aorta, arteries, and arterioles. Arterioles are small muscular arteries that regulate blood pressure by changing tone (resistance). **B,** A schematic representation of the cardiac conduction system.

gives rise to the PDA and the LCx gives rise to the PLV in a *co-dominant circulation*.

CONDUCTION SYSTEM

The sinoatrial (SA) node is a collection of specialized pacemaker cells, 1 to 2 cm long, that is located in the right atrium between the superior vena cava and the right atrial appendage (see Fig. 2-1B). The SA node is supplied by the SA nodal artery, which is a branch of the RCA in about 60% of the population and a branch of the LCx in about 40%. An electrical impulse originates in the SA and is conducted to the AV node by internodal tracts within the atria.

The AV node is a critical electrical interface between the atria and ventricles, because it facilitates electromechanical coupling. The AV node is a located at the inferior aspect of the right atrium, between the coronary sinus and the septal leaflet of the tricuspid valve. The AV node is supplied by the AV nodal artery, which is a branch of the RCA in about 90% of the population and a branch of the LCx in 10%. Electrical impulse conduction slows through the AV node and continues to the ventricles by means of the His-Purkinje system. The increased impulse time through the AV node allows for adequate ventricular filling.

The bundle of His extends from the AV node down the membranous interventricular septum to the muscular septum, where it divides into the left and right bundle branches, finally terminating in Purkinje cells, which are specialized cells that facilitate the rapid propagation of electrical impulses. The Purkinje cells directly stimulate myocytes to contract. The right bundle and the left bundle are supplied by septal perforator branches from the LAD. The distal and posterior portion of the left bundle has an additional blood supply from the AV nodal artery (PDA origin); for that reason, it is more resistant to ischemia. Conduction can be impaired at any point, from ischemia, medications (e.g., β-blockers, calcium channel blockers), infection, or congenital abnormalities. Please refer to Chapter 61, "Principles of Electrophysiology," in *Goldman-Cecil Medicine*, 25th Edition.

NEURAL INNERVATION

The autonomic nervous system is an integral component in the regulation of cardiac function. In general, sympathetic stimulation increases the heart rate (HR) (chronotropy) and the force of myocardial contraction (inotropy). Sympathetic stimulation commences in preganglionic neurons located within the superior five or six thoracic segments of the spinal cord. They synapse with second-order neurons in the cervical sympathetic ganglia and then propagate the signal through cardiac nerves that innervate the SA node, AV node, epicardial vessels, and myocardium. The parasympathetic system produces an opposite physiologic effect by decreasing HR and contractility. Its neural supply originates in preganglionic neurons within the dorsal motor nucleus of the medulla oblongata, which reach the heart through the vagus nerve. These efferent neural fibers synapse with second-order neurons located in ganglia within the heart which terminate in the SA node, AV node, epicardial vessels, and myocardium to decrease HR and contractility. Conversely, afferent vagal fibers from the inferior and posterior aspects of the ventricles, the aortic arch, and the carotid sinus conduct sensory information back to the medulla, which mediates important cardiac reflexes.

MYOCARDIUM

The proper cellular organization of cardiac tissue (myocardium) is critical for the generation of efficient myocardial contraction. Disruptions in this structure and organization lead to cardiac dyssynchrony and arrhythmias, which cause significant