



CORONARY CIRCULATION (coron~crown)

Superior

vena cava



6

Pulmonary trunk Left auricle Right atrium CORONARY SINUS SMALL · CARDIAC GREAT ANTERIOR CARDIAC CARDIAC MIDDLE -CARDIAC Left ventricle Right ventricle Inferior vena cava

(a) Anterior view of coronary arteries

(b) Anterior view of coronary veins









(c) Anterior view

HEART VALVES



Superior view (the atria have been removed)





(c) Tricuspid valve open



valves closed, bicuspid and tricuspid valves open.

valves open, bicuspid and tricuspid valves closed.

- . When blockage of a coronary artery deprives the heart muscle of oxygen, reperfusion, the reestablishment of blood flow, may damage the tissue further. This surprising effect is due to the formation of oxygen free radicals from the reintroduced oxygen.
- free radicals are electrically charged molecules that have an unpaired electron .
- These unstable, highly reactive molecules cause chain reactions that lead to cellular damage and death.
- To counter the effects of oxygen free radicals, body cells produce enzymes that convert free radicals to less reactive substances.
- Two such enzymes are superoxide dismutase and catalase.
- In addition, nutrients such as vitamin E, vitamin C, beta-carotene, zinc, and selenium serve as antioxidants, which remove oxygen free radicals from circulation.
- Drugs that lessen reperfusion damage after a heart attack or stroke are currently under development.

CLINICAL CONNECTION Myocardial Ischemia and Infarction

Partial obstruction of blood flow in the coronary arteries may cause **myocardial ischemia** (is-KĒ-mē-a; *ische-* = to obstruct; *-emia* = in the blood), a condition of reduced blood flow to the myocardium. Usually, ischemia causes **hypoxia** (reduced oxygen supply), which may weaken cells without killing them. **Angina pectoris** (an-JĪ-na, or AN-ji-na, PEK-to-ris), which literally means "strangled chest," is a severe pain that usually accompanies myocardial ischemia. Typically, sufferers describe it as a tightness or squeezing sensation, as though the chest were in a vise. The pain associated with angina pectoris is often referred to the neck, chin, or down the left arm to the elbow. **Silent myocardial ischemia,** ischemic episodes without pain, is particularly dangerous because the person has no forewarning of an impending heart attack.

A complete obstruction to blood flow in a coronary artery may result in a **myocardial infarction** (in-FARK-shun), or **MI**, commonly called a *heart attack. Infarction* means the death of an area of tissue because of interrupted blood supply. Because the heart tissue distal to the obstruction dies and is replaced by noncontractile scar tissue, the heart muscle loses some of its strength. Depending on the size and location of the infarcted (dead) area, an infarction may disrupt the conduction system of the heart and cause sudden death by triggering ventricular fibrillation. Treatment for a myocardial infarction may involve injection of a thrombolytic (clot-dissolving) agent such as streptokinase or t-PA, plus heparin (an anticoagulant), or performing coronary angioplasty or coronary artery bypass grafting. Fortunately, heart muscle can remain alive in a resting person if it receives as little as 10–15% of its normal blood supply.