Circulatory systems facilitate exchange with all body tissues

Figure 1: The open circulatory system in a grasshopper

Figure 2: The closed circulatory system in a fish
Vertebrate cardiovascular systems reflect evolution

Figure 3: Single circulation, two-chambered heart

Figure 4: Double circulation, three-chambered heart

Figure 5: Double circulation, four chambered heart
Diagram 1: Blood flow through the double circulation of the human cardiovascular system
The human cardiovascular system (cont.)

Figure 6: Blood flow through the human heart
The heart contracts and relaxes rhythmically.

Diagram 2: A cardiac cycle in a human with a heart rate of about 72 beats per minute.
The pacemaker sets the tempo of the heartbeat

Figure 7: An artificial pacemaker implanted in the chest
What is a heart attack?

Figure 8: Blockage of a coronary artery, resulting in a heart attack
What is a heart attack? (cont.)

**Figure 9:** Atherosclerosis: a normal artery (left) and an artery partially closed by plaque (right)
The structure of blood vessels fits their functions

**Figure 10**: Diffusion between blood and tissue cells
The structure of blood vessels fits their functions (cont.)

**Figure 11:** Structural relationships of blood vessels
Blood Pressure

Figure 12: Blood pressure and velocity in the blood vessels
Measuring blood pressure can reveal cardiovascular problems

Diagram 3: Measuring blood pressure
Smooth muscle controls the distribution of blood

**Figure 13:** The control of capillary blood flow by precapillary
Capillaries allow the transfer of substances through their walls

Diagram 4: The movement of fluid into and out of a capillary
Blood consists of red and white blood cells suspended in plasma.

**Figure 14:** The composition of blood
Too few or too many red blood cells can be unhealthy

Figure 15: Human red blood cells
Blood clots plug leaks when blood vessels are injured

Diagram 5: The blood-clotting process
Stem cells offer a potential cure for blood cell diseases

Figure 16: Differentiation of blood cells from stem cells