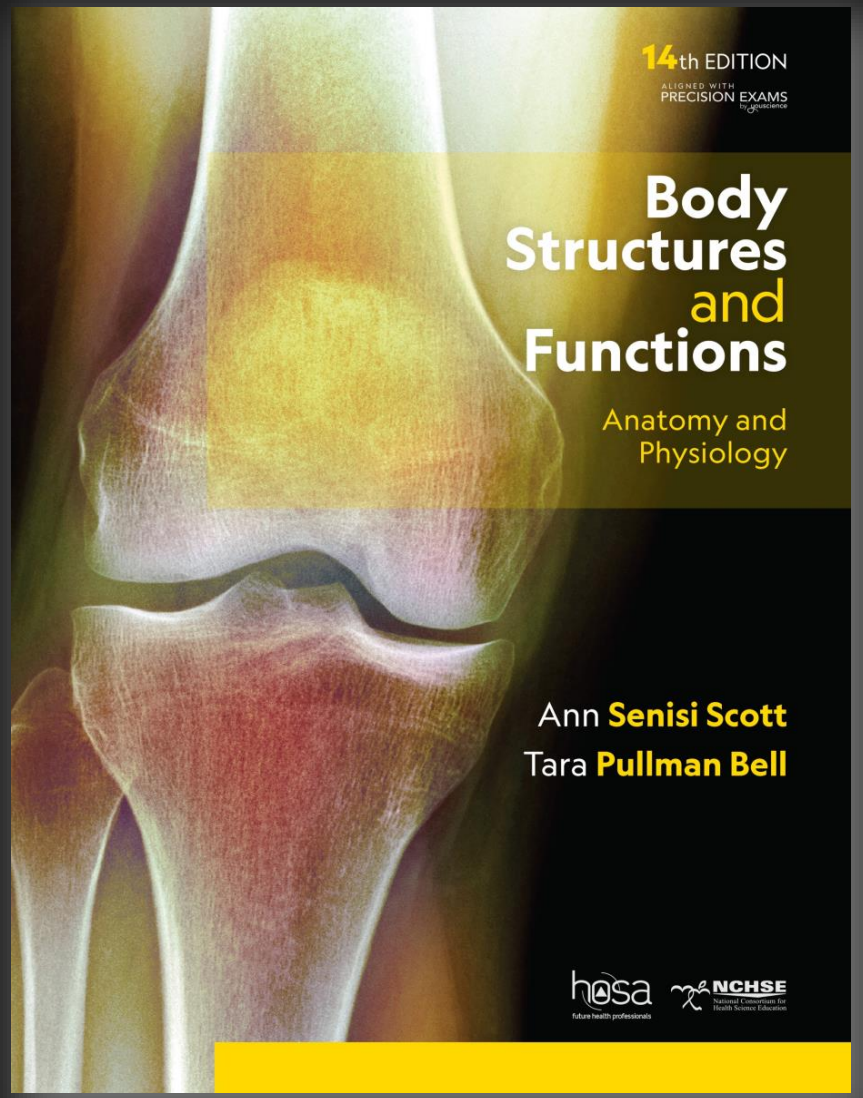
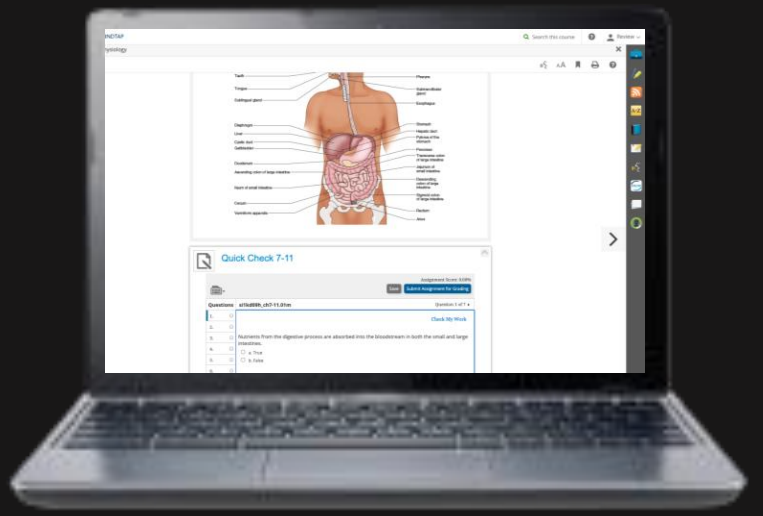


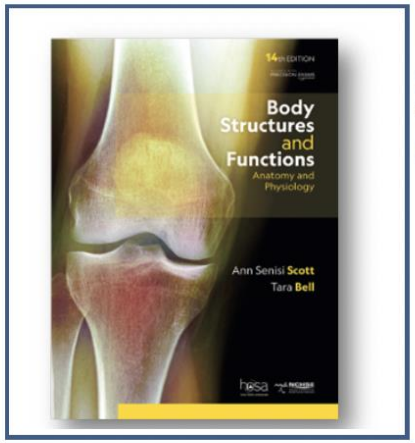
NATIONAL GEOGRAPHIC LEARNING | Cengage

Body Structures and Functions



ANATOMY AND PHYSIOLOGY

ALIGNED TO THE NGSSS FLORIDA STANDARDS



FLORIDA Standards Correlations

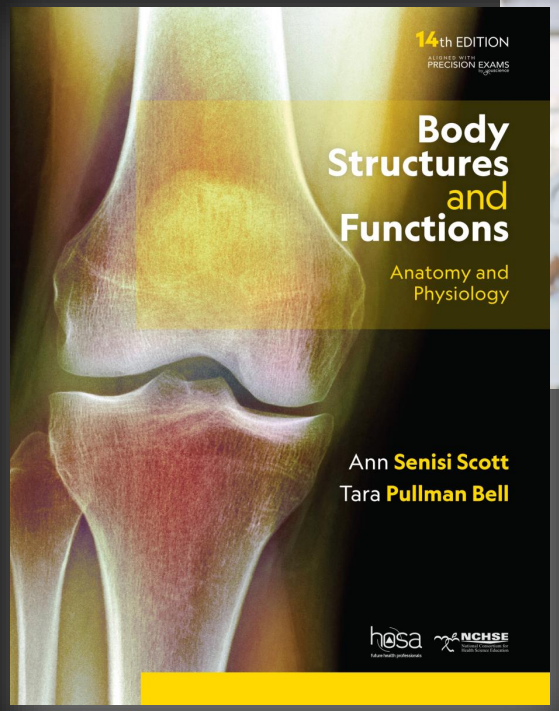
Next Generation Sunshine State Standards

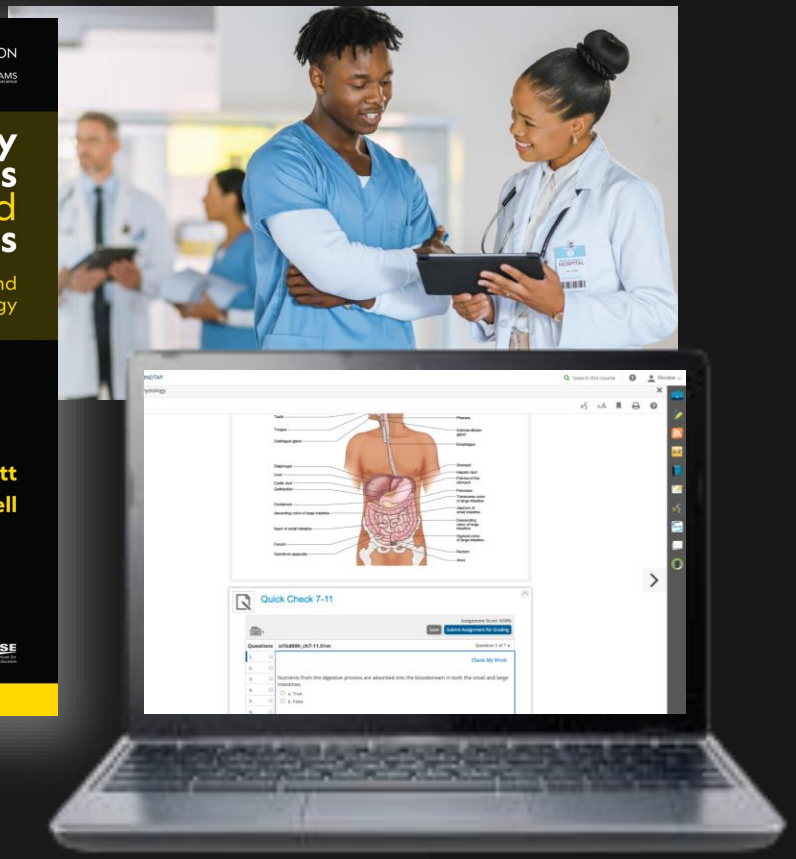
Anatomy and Physiology, Body Structures and Functions, 9-12

STANDARD	STUDENT/TEACHER EDITION	MTRs and EEs
SC.912.L.14.11 Classify and state the defining characteristics of epithelial tissue, connective tissue, muscle tissue, and nervous tissue	Chapter 5. Pages: 67-78 - Students describe and define function and location of epithelial, connective, muscle, and nervous tissue. Describe the process involved in tissue repair.	MA.K12.MTR.1.1 ELA.K12.EE.1.1
SC.912.L.14.12 Describe the anatomy and histology of bone tissue.	Chapter 5. Pages: 67-78 - Students describe and define function and location of epithelial, connective, muscle, and nervous tissue. Describe the process involved in tissue repair.	MA.K12.MTR.1.1 ELA.K12.EE.1.1
SC.912.L.14.13 Distinguish between bones of the axial skeleton and the appendicular skeleton.	Chapter 7. Pages: 105-108. Lab Activity 7-1, p. 135. Students learn the function of the skeletal system. Bone structure and formation. Lab activity to examine the histology of a long bone.	MA.K12.MTR.1.1 ELA.K12.EE.3.1
SC.912.L.14.14 Identify the major bones of the axial and appendicular skeleton.	Chapter 7. Pages: 109-118. Lab Activity 7-2, p. 135. Students distinguish parts of the skeletal system: axial and appendicular skeleton. Lab	MA.K12.MTR.1.1 ELA.K12.EE.1.1

NATIONAL GEOGRAPHIC LEARNING | Cengage

Body Structures and Functions



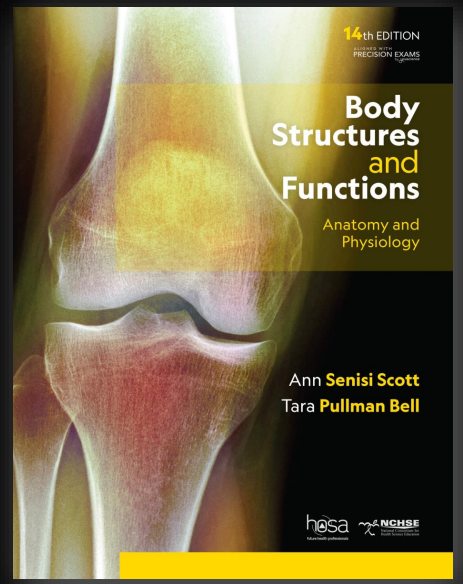


Engage

Prepare

Succeed

Developed specifically for High School students, *Body Structures & Functions* offers hands-on learning to understand body systems and their interrelationships, with a focus on clinical applications.



NATIONAL GEOGRAPHIC LEARNING | Cengage

Chapter 1 – Scientific Investigation and Lab Practices

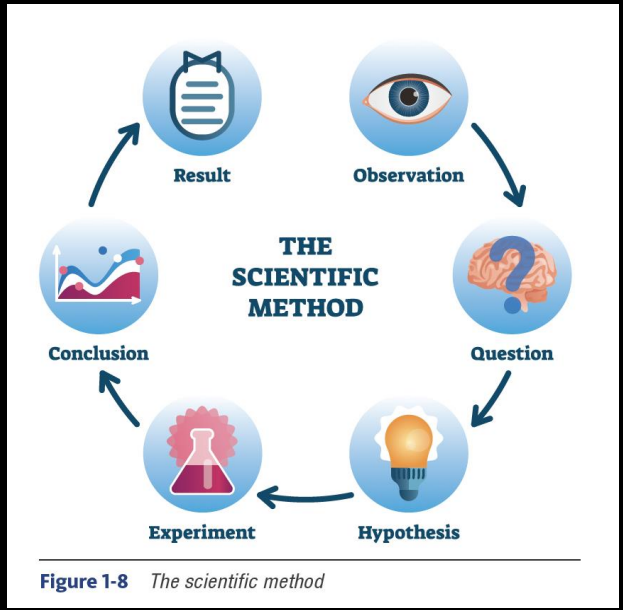


Figure 1-8 *The scientific method*

WORKING ON A TEAM

Communication is fundamental when working as a part of a team (**Figure 1-11**). Dissemination of information comes in different forms, with each being as important as the next.

Communication

Communication amongst team members is essential to reach goals. There are skills that may come naturally for some, whereas other skills must be practiced. See **Figure 1-12** for examples of barriers to effective communication.

Listening is one of the most important components of communication. Communication cannot occur

idents working together as a team

Table 1-7 *Investigation Steps of Scientific Investigations (Designs)*

DESCRIPTIVE	*COMPARATIVE*	*EXPERIMENTAL*	*OBSERVATIONAL*
• observations • hypothesis or exploration • conduct background research • procedures • variables (independent and dependent) • qualitative and/or quantitative data • conclusion	• observations • scientific research question • hypothesis • procedures • variables (independent and dependent) • qualitative and/or quantitative data • conclusion	• observations • scientific research question • hypothesis • procedures • variables (independent and dependent) • control and experimental group • quantitative data • conclusion	• observations • objective • underlying theory research • procedure • observation • qualitative and/or quantitative data • conclusion

Key Words *continued*

tricuspid atresia
tunica adventitia (externa)
tunica intima
tunica media
valves
varicose veins
vascular malformations
veins
venipuncture
ventricular septal defect
venules
white-coat hypertension

Blood vessels circulate blood through two major circulatory systems (**Figure 15-1**):

1. *Cardiopulmonary circulation*—blood from the heart to the lungs for oxygen and back to the heart
2. *Systemic circulation*—blood from the heart to the tissues and cells and back to the heart

Specialized systemic routes are as follows:

a. *Coronary circulation*—brings blood from the heart to the myocardium

b. *Portal circulation*—takes blood from the organs of digestion to the liver through the portal vein

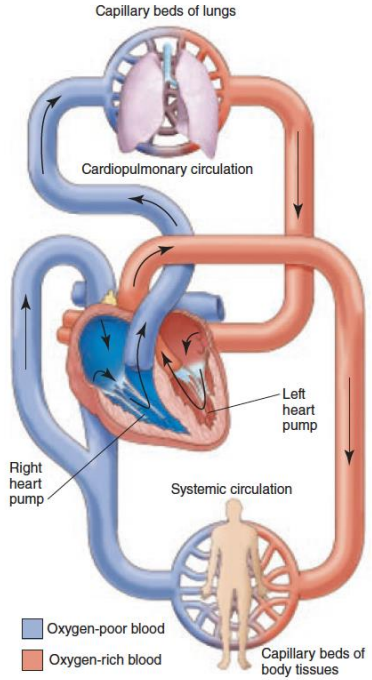


Figure 15-1 *Systemic circulation*

c. *Fetal circulation*—occurs in the pregnant female; fetus obtains oxygen and nutrients from the mother's blood

CARDIOPULMONARY CIRCULATION

Cardiopulmonary circulation takes deoxygenated blood from the heart to the lungs, where carbon dioxide is exchanged for oxygen. The oxygenated blood returns to the heart. As stated in Chapter 14, blood enters the right atrium, which contracts, forcing the blood through the tricuspid valve into the right ventricle.

The right ventricle contracts to push the blood through the pulmonary valve into the main pulmonary artery. The main pulmonary artery bifurcates, or divides in two. It branches into the right pulmonary artery, bringing blood to the right lung, and into the left pulmonary artery, bringing blood to the left lung (**Figure 15-2**).

Inside the lungs, the pulmonary arteries branch into countless small arteries called **arterioles** (ar-TEE-ree-ohlz). The arterioles connect to dense beds of capillaries lying in the alveoli lung tissue. Here, gaseous exchange takes place by the process of diffusion. Carbon dioxide leaves the red blood cells and is discharged into the air in the alveoli, to be excreted from the lungs. Oxygen from air in the alveoli combines with hemoglobin in the red blood cells. From these capillaries, the blood travels into small veins or **venules** (VEN-youls) (**Figure 15-3**). Venules from the right and left lungs form large pulmonary veins. These veins carry oxygenated blood from the lungs back to the heart and into the left atrium.

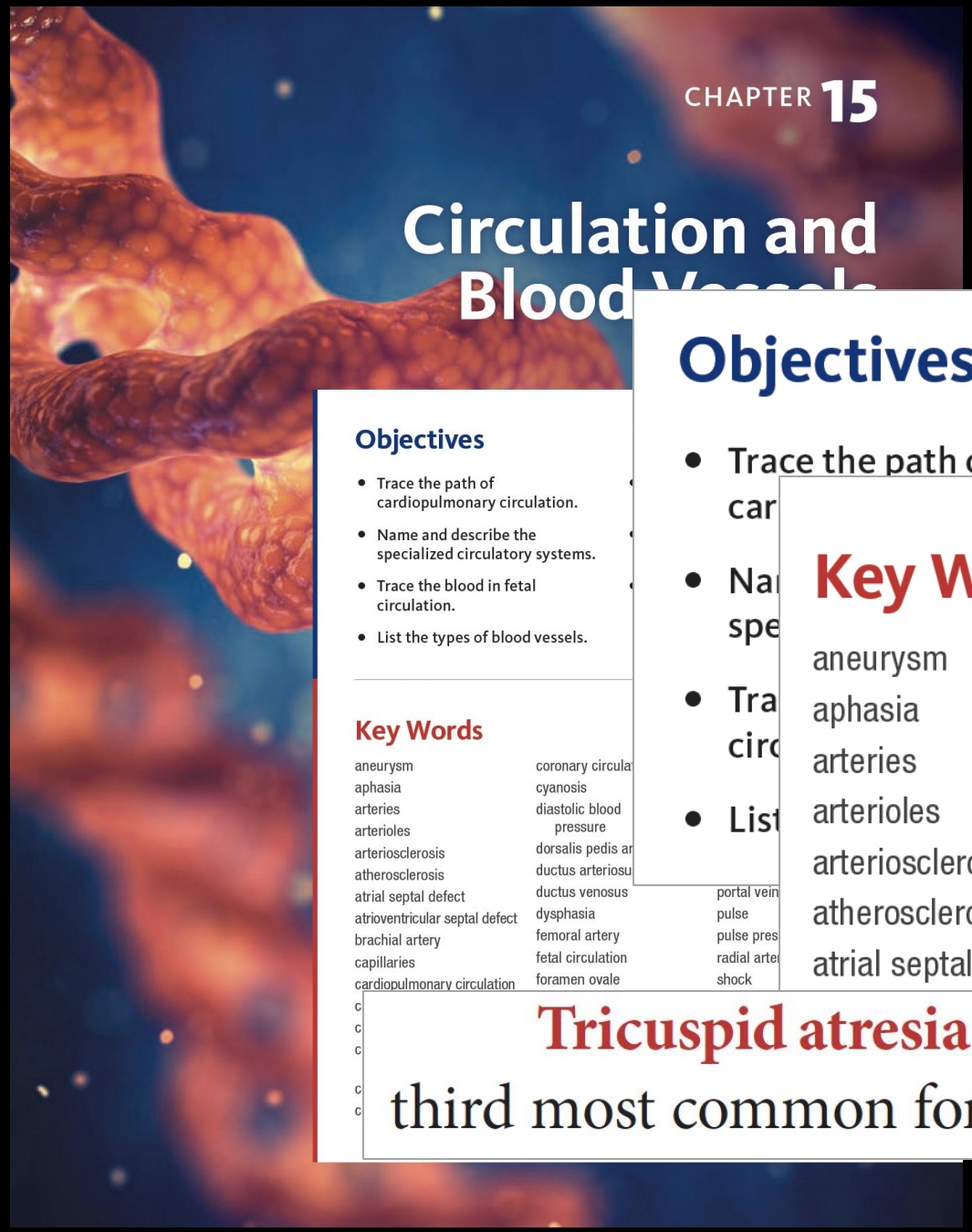
The left atrium contracts, sending blood through the bicuspid, or mitral valve, into the left ventricle. This chamber then acts as a pump for newly oxygenated blood. When the left ventricle contracts, it sends oxygenated blood through the aortic semilunar valve into the aorta.

SYSTEMIC CIRCULATION

The function of the general circulation, or **systemic circulation**, is fourfold: it circulates chemicals, such as nutrients, oxygen, water, and secretions, to the tissues

Thoughtfully Designed for Ease of Learning

Chapter Introduction



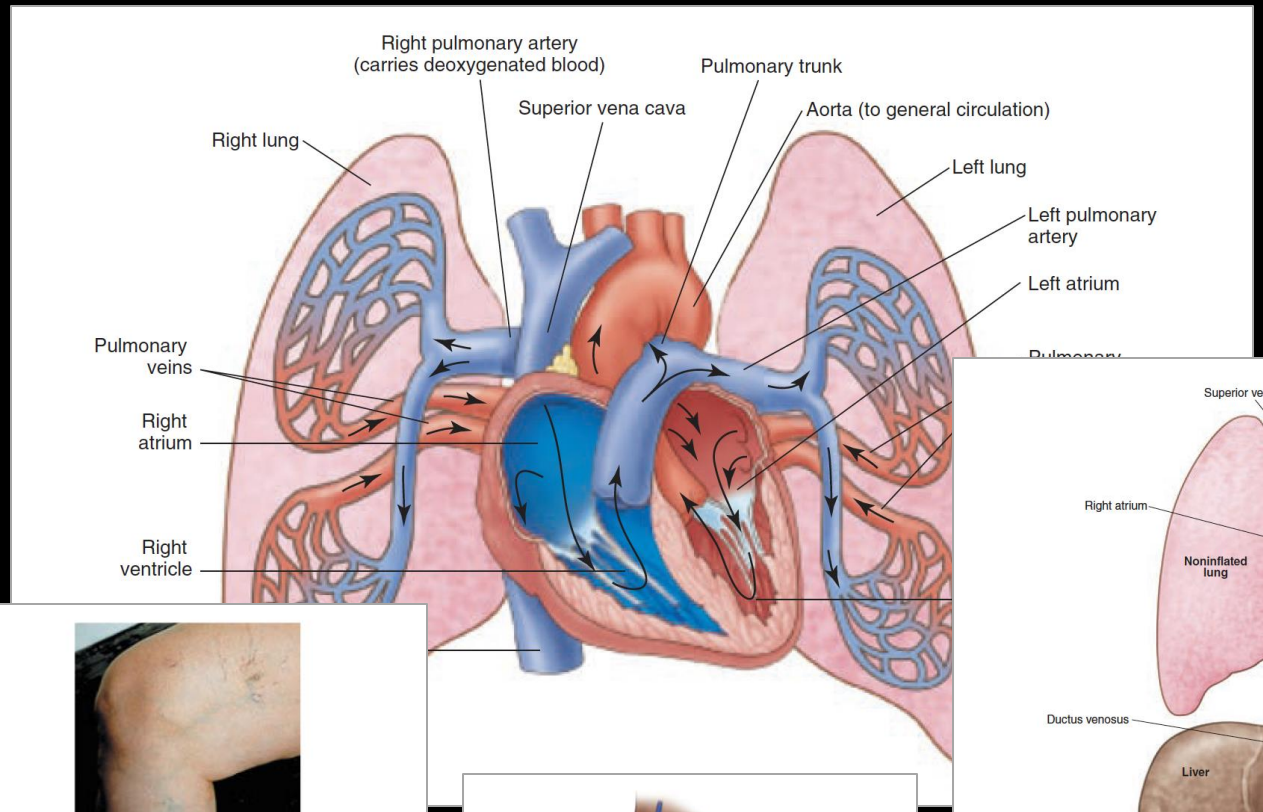
Objectives

- Trace the path of cardiopulmonary circulation.
- Name and describe the specialized circulatory systems.
- Trace the blood in fetal circulation.
- List the types of blood vessels.

Key Words

aneurysm
aphasia
arteries
arterioles
arteriosclerosis
atherosclerosis
atrial septal defect
atrioventricular septal defect
brachial artery
capillaries
cardiopulmonary circulation
coronary circulation
cyanosis
diastolic blood pressure
dorsalis pedis artery
ductus arteriosus
ductus venosus
dysphasia
femoral artery
fetal circulation
foramen ovale
mean arterial pressure (MAP)
peripheral vascular disease (PVD)
phlebitis
popliteal artery
portal circulation
portal vein
pulse
pulse pressure
radial artery
shock

Tricuspid atresia (try-cusp-id uh-**TREE**-zuh) is the third most common form of congenital heart defect. The



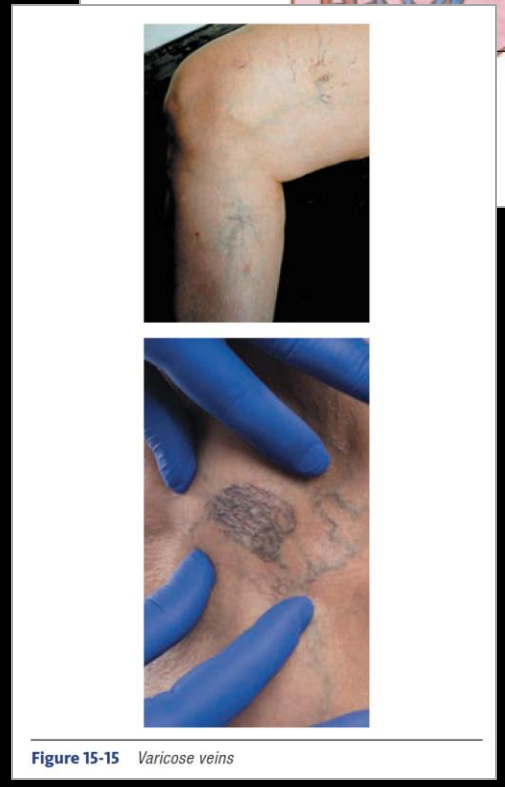


Figure 15-15 *Varicose veins*

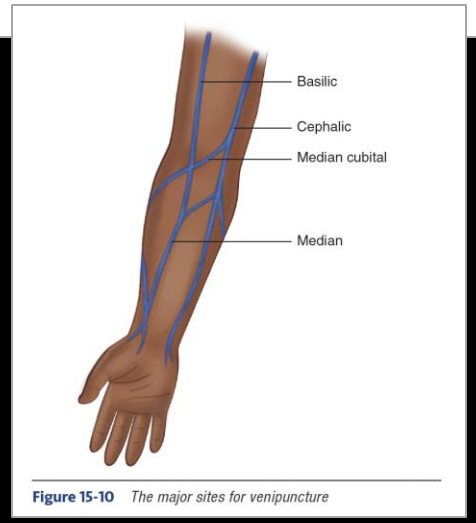


Figure 15-10 *The major sites for venipuncture*

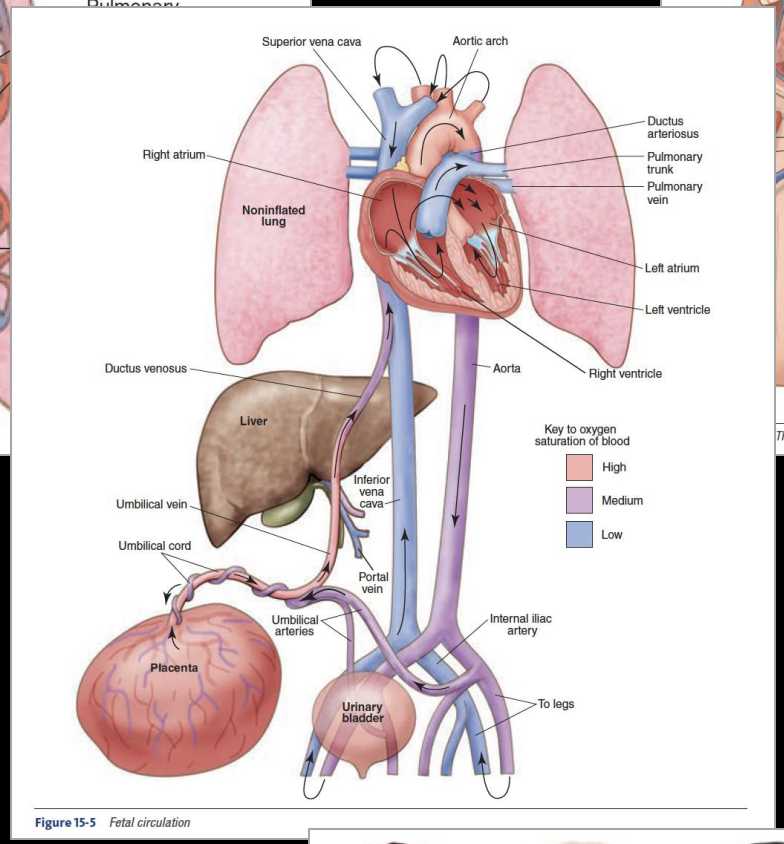
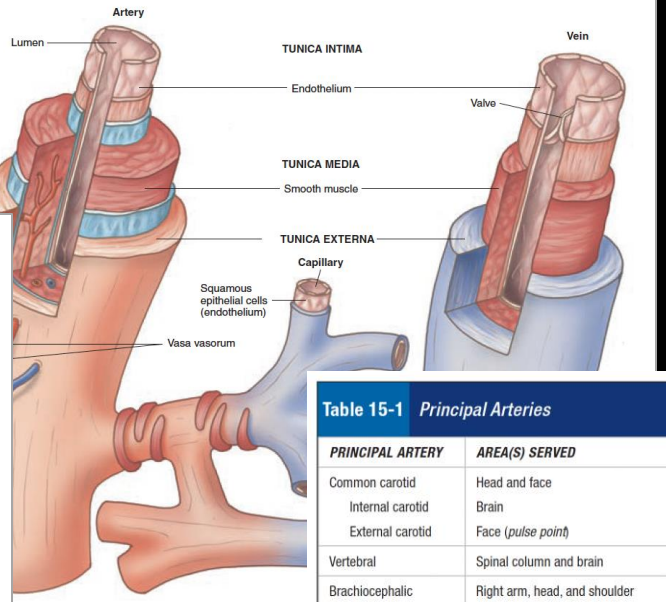


Figure 15-5 *Fetal circulation*



The three layers of the walls of the arteries and veins: tunica

Table 15-1 *Principal Arteries*

PRINCIPAL ARTERY	*AREA(S) SERVED*
Common carotid	Head and face
Internal carotid	Brain
External carotid	Face (*pulse point*)
Vertebral	Spinal column and brain
Brachiocephalic	Right arm, head, and shoulder
Subclavian	Shoulder
Axillary	Axilla
Brachial	Upper arm and elbow area (*pulse point*)
Radial	Arm, wrist (*pulse point*)
Thoracic aorta	Chest cavity
Splenic	Spleen
Hepatic	Liver
Superior mesenteric	Small intestines and colon
Renal	Kidney
Common iliac	Lower abdomen
Internal iliac	Pelvis and bladder
External iliac	Groin and lower leg
Femoral	Groin (*pulse point*)
Popliteal	Knee area (*pulse point*)
Anterior tibial	Anterior lower leg

Tables and Charts

Table 15-1 *Principal Arteries*

PRINCIPAL ARTERY	*AREA(S) SERVED*
Common carotid	Head and face
Internal carotid	Brain
External carotid	Face (*pulse point*)
Vertebral	Spinal column and brain
Brachiocephalic	Right arm, head, and shoulder
Subclavian	Shoulder
Axillary	Axilla
Brachial	Upper arm and elbow area (*pulse point*)
Radial	Arm, wrist (*pulse point*)
Thoracic aorta	Chest cavity
Splenic	Spleen
Hepatic	Liver
Superior mesenteric	Small intestines and colon
Renal	Kidney
Common iliac	Lower abdomen
Internal iliac	Pelvis and bladder
External iliac	Groin and lower leg
Femoral	Groin (*pulse point*)
Popliteal	Knee area (*pulse point*)
Anterior tibial	Anterior lower leg
Posterior tibial	Posterior lower leg
Dorsalis pedis	Ankle (*pulse point*)

Table 15-2 *Principal Veins*

PRINCIPAL VEIN	*AREA(S) SERVED*
External jugular	Face
Internal jugular	Head and neck
Subclavian	Shoulder and upper limbs
Brachiocephalic	Head and shoulder
Cephalic	Shoulder and axilla
Axillary	Axilla
Brachial	Upper arm
Radial	Lower arm and wrist
Superior vena cava	Upper part of body
Inferior vena cava	Lower part of body and abdomen area
Hepatic	Liver
Renal	Kidney
Hepatic portal	Organs of digestion
Splenic	Spleen
Superior mesenteric	Small intestine and colon
Common iliac	Lower abdomen and pelvis
Internal iliac	Bladder and reproductive organs
External iliac	Lower limbs
Great saphenous	Upper leg
Femoral	Upper leg and groin
Popliteal	Knee
Posterior tibial	Posterior leg
Dorsal venous arch	Foot

The Effects of Aging

The Effects of Aging

on Circulation and Blood Vessels

The arteries that are pliable and elastic when young become less elastic, dilated, and elongated with age. These physiological changes mean the heart has to work harder to push blood through the arteries. Arterial changes appear to be widespread and result in diminished circulation to organs and tissues.

A frequent cardiovascular measure is blood pressure (BP). It is debatable how aging affects this measure of cardiovascular status. Some researchers believe normal BP for older people is typically 140 mm Hg systolic (ventricle contraction) and 90 mm Hg (ventricle relaxation) diastolic (140/90).

Some researchers think systolic increases are due to reduced aortic elasticity which can cause an increase in pulse pressure, the difference between the systolic and diastolic pressure; others believe that peripheral resistance in the vessels causes an increase in systolic and diastolic pressures and an increased mean arterial pressure, which is the average arterial pressure throughout one cardiac cycle.

In the carotid arteries, the baroreceptors—the neural receptors sensitive to blood pressure—become rigid and less sensitive to pressure changes with aging. This results in a slow response to postural changes, which may cause dizziness and fainting. This hypotensive response is called orthostatic hypotension. Under normal circumstances, the heart continues to adequately supply blood to all parts of the body. However, an aging heart may be less able

Career Profile

REGISTERED NURSE AND NURSE PRACTITIONER

Registered nurses (RNs) provide for the physical, mental, and emotional needs of their patients. They observe, assess, and record symptoms, reactions, and progress; they also assist physicians during treatments and examinations, administer medications, and assist in convalescence and rehabilitation. Registered nurses develop nursing care plans, instruct patients and their families in proper care, and help individuals and groups improve and maintain their health.

Registered nurses work in hospitals, the home, offices, nursing homes, public health services, and industries.

In all states, students must graduate from an accredited school of nursing and pass a national licensing examination to become an RN. There are three major educational paths to nursing: associate's degree in nursing (ADN) prog
years, Bachelor of Sc
ing (BSN) degree prog
years, and diploma p
in hospitals last two t

The employmer
expected to be abo
the coming years. The job outlook is best for the nurse with a BSN.

A nurse practitioner or nurse clinician is an RN with a master's degree and clinical experience in a particular branch of nursing. The nurse practitioner has acquired expert knowledge in a specific

Career Profile

LICENSED PRACTICAL NURSE

Licensed practical nurses (LPNs), or licensed vocational nurses (LVNs) as they are called in Texas and California, care for people who are sick, injured, convalescing, or handicapped under the direction of a physician or registered nurse.

Most LPNs provide basic bedside care. They take vital signs, treat bedsores, prepare and give injections, and administer some treatments. They collect laboratory specimens, observe patients, and report any adverse reactions. They help patients with activities of daily living, keep them comfortable, and care for their emotional needs. In states where the law allows, they may administer prescribed medicines.

Licensed practical nurses in nursing homes also evaluate residents' needs, develop care plans, and supervise nursing aides.

All states require LPNs to graduate from an accredited practical nursing program and pass a national licensing examination.

The job outlook for the practical nurse is good and is expected to increase faster than the average during the next few years.

One BODY

How the Cardiovascular System Interacts with Other Body Systems

The cardiovascular system plays a role in the maintenance of all body systems by carrying oxygen, nutrients, and hormones to all cells and carrying away cellular waste products and carbon dioxide for excretion by the body.

INTEGUMENTARY SYSTEM

- The capillary network in the skin helps maintain body temperature.

SKELETAL SYSTEM

- Red bone marrow produces blood cells.
- The bones of the thoracic cavity protect the heart and major blood vessels.

MUSCULAR SYSTEM

- The action of the muscles helps return venous blood to the heart.

NERVOUS SYSTEM

- The autonomic nervous system influences the heart rate and blood pressure.

ENDOCRINE SYSTEM

- The blood serves as the transport medium for hormones produced by the endocrine system.
- The hormones adrenaline and thyroxine affect the heart rate.

LYMPHATIC SYSTEM

- Lymphocytes are carried by the blood to sites of infection and inflammation.

RESPIRATORY SYSTEM

- The exchange of gases between carbon dioxide and oxygen takes place in the capillary network of the lungs.

DIGESTIVE SYSTEM

- Blood picks up the end products of digestion for distribution to other organs of the body.

URINARY SYSTEM

- Blood pressure affects the filtration rate in the kidneys.
- As the blood is filtered through the kidneys, waste products, excess electrolytes, and excess fluid are removed; this action preserves blood volume.

REPRODUCTIVE SYSTEM

- Estrogen maintains vascular health in women.
- Engorgement of the blood vessels in the male maintains erection of the penis.

Medical Terminology

a-	without	**dys-**	difficult
phas	speech	**dys/phas/ia**	pertaining to difficulty in speech
-ia	abnormal condition of	**embol**	plug or clot
a/phas/ia	abnormal condition of being without speech	**-ism**	condition of
arterio	arteries	**embol/ism**	condition of having a blood clot
-sclerosis	hardening	**hemi-**	half
arterio/sclerosis	hardening of the arteries	**-plegia**	paralysis
athero	fatty	**hemi/plegia**	condition of paralysis on one side or half
athero/sclerosis	hardening of the arteries by fat	**hyper-**	over or excessive
cerebr	main brain	**tens**	condition of tension or pressure
-al	pertaining to	**-ion**	process of
vascular	blood vessels	**hyper/tens/ion**	condition of excessive blood pressure
cerebr/al vascular accident	accident pertaining to the blood vessels in the main brain	**hypo-**	under or low
cyan	blue	**hypo/tens/ion**	condition of low blood pressure
-osis	process of becoming	**phleb**	vein
cyan/osis	process of becoming blue	**-itis**	inflammation of
diastol	relaxation	**phleb/itis**	inflammation of a vein
-ic	pertaining to	**systole**	contraction
diastol/ic pressure	pertaining to the relaxation phase of the heart cycle	**systol/ic pressure**	pertaining to the contraction phase of the heart cycle

End-of-Chapter Content

REVIEW QUESTIONS

Select the l

1. The n
myoca
a. cor
b. bra
c. aor
d. sub

2. Specia
organs
a. cor
b. feta
c. car
d. por

3. The m
a. pop
b. dor
c. rad
d. tem

4. The bl
the he
a. pul
b. pul
c. cor
d. cor

5. The inner layer of the artery is called the
a. tunica adventitia.
b. tunica intima.
c. tunica media.
d. externa.

MATCHING

Match each te

SHORT ANSWER

1. Compar
arteries,

2. Explain
gasses, a
and exte
layers, cl

3. Describ
and bloc

APPLYING THEORY TO PRACTICE

1. You are a red blood cell, and you are leaving the
arch of th
great toe.
which yo

2. You are a
need oxy
Trace you
lungs. Na
through
chemical
system?

3. Your gran
vascular
result of a
arteriosc

following arteries are affected—carotid artery,

CASE STUDY

Mrs. William arrives in the emergency department with her son George. She cannot speak, and there is weakness and numbness on her right side. She is seen by Victoria, the nurse practitioner, who also notices a drooping on the right side of Mrs. William's face. George states that his mother was fine and eating her breakfast when this occurred. Victoria checks the woman's blood pressure, and it is 200/100. The emergency department physician and Victoria examine the patient, and the physician makes the diagnosis of a CVA.

1. Describe what a CVA is. What is the other name given to a CVA?
2. What is the correlation between Mrs. William's blood pressure and her CVA?
3. What other body systems will be affected because of the CVA?
4. What is the major cause of strokes?
5. Investigate and report the simple diagnostic tests Victoria will do to determine Mrs. William's state of paralysis.
6. Mrs. William cannot speak. Which side of her brain was affected?
7. Investigate and report some of the therapeutic technologies that will help Mrs. William in her recovery.
8. Explain some of the actions people can take to avoid a CVA.

End-of-Chapter Content

LAB ACTIVITY 15-1 Structure of Blood Vessels

- ***Objective:*** To o
- ***Materials neede***

Step 1: Put on

Step 2: Observ artery. you se

Step 3: Observ Record see.

Step 4: What i the vei

LAB ACTIVITY 15-2 Principal Arteries and Veins

- ***Objective:*** To locate a
- ***Materials needed:*** u a

Step 1: Locate and n chart that su regions with upper arm, ra stomach, spl fibula, and pe arteries in th

Step 2: Compare you chapter of th

Step 3: Locate and r blood to the

LAB ACTIVITY 15-3 Vital Signs

- ***Objective:*** To determine the pulse points in the body and to take a pulse
- ***Materials needed:*** wristwatch with second hand, textbook, paper, pencil
- ***Note:*** This activity must be done with a lab partner.

Step 1: Have your lab partner sit with the wrist resting on a table.

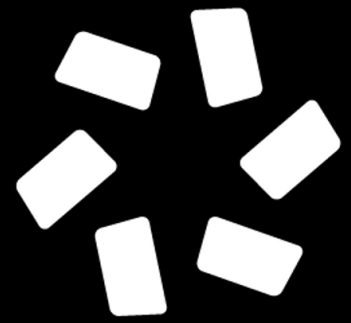
Step 2: Locate your partner's radial pulse with the pads of your first three fingers. (Remember: Do not use the thumb because it has its own pulse.)

Step 3: Gently compress the radial artery to feel the pulse.

Step 4: Count the pulse for one full minute. Take notice of the rhythm and volume. Record the pulse and describe any irregularities you notice.

Step 5: On your lab partner, locate and take the pulse at the following pulse points: temporal, carotid, brachial, popliteal, and dorsalis pedis. Compare locations with the diagram in this chapter of the textbook. Record the count at each pulse point. Record and explain any differences in your answer.

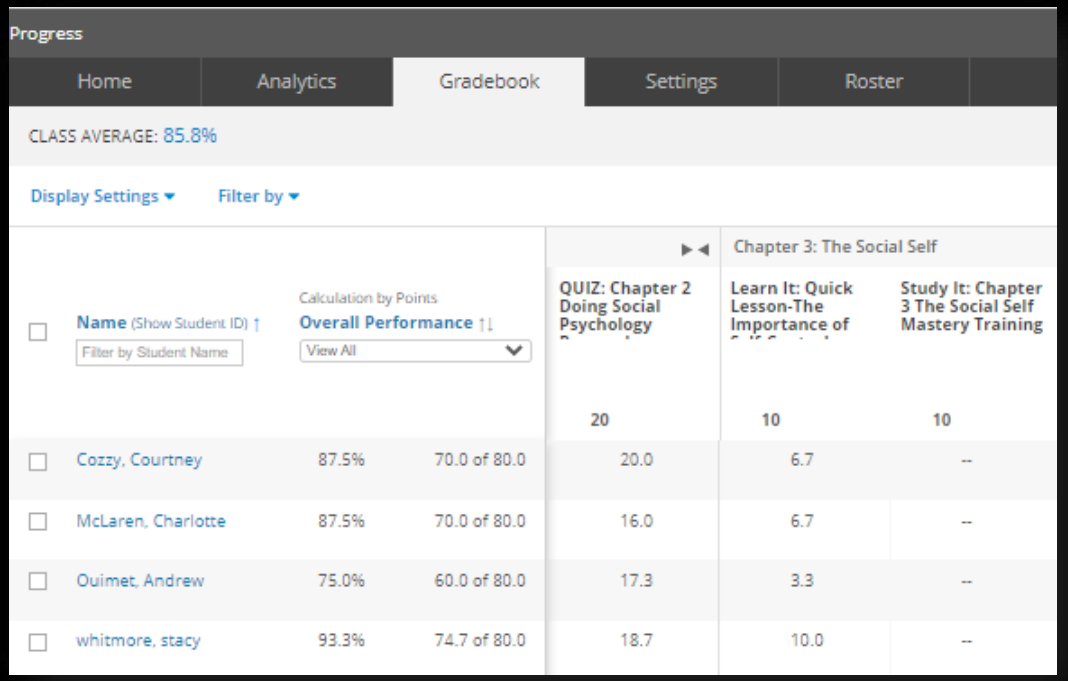
Step 6: Switch places with your lab partner and repeat steps 1–5.

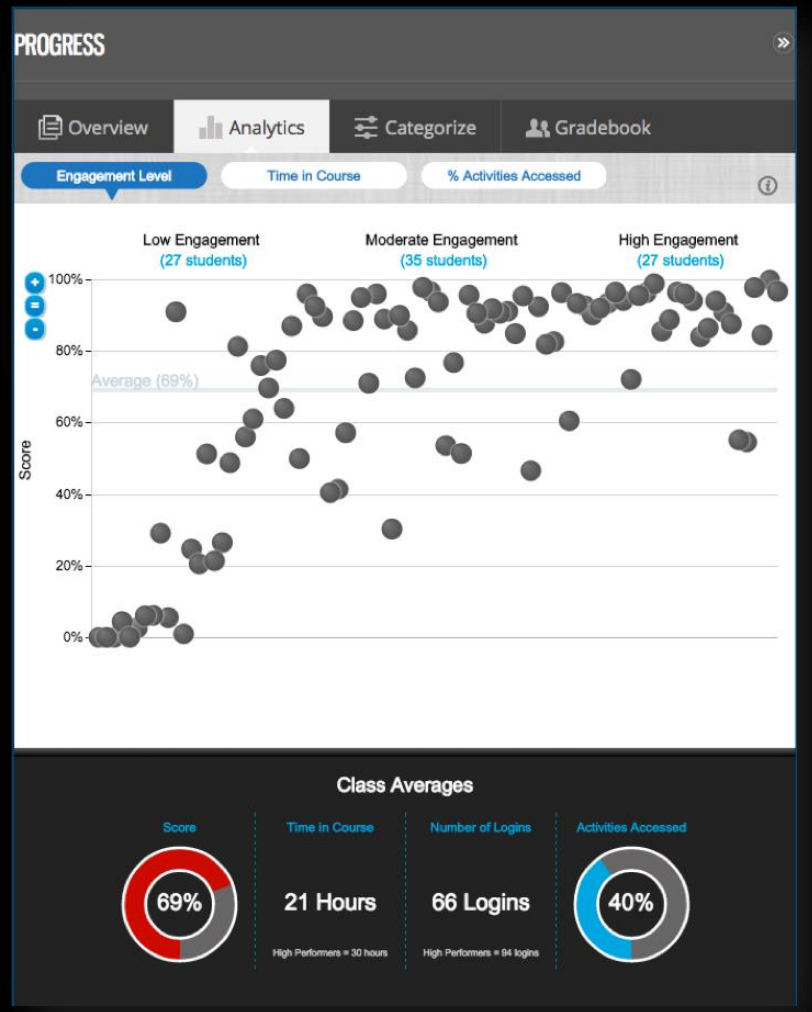


Cengage MindTap

NATIONAL GEOGRAPHIC LEARNING | Cengage

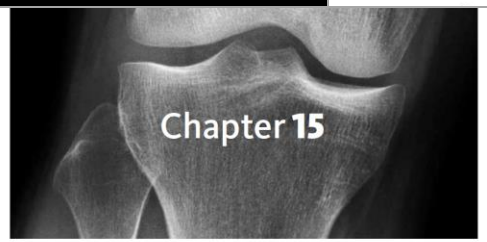
Cengage MindTap





NATIONAL GEOGRAPHIC LEARNING | Cengage

Student Workbook



Circulation and Blood Vessels

OVERVIEW

The arteries, capillaries, and veins circulate the blood to all parts of the body through cardiopulmonary and systemic circulation.

In *cardiopulmonary circulation*, blood travels from the heart to the lungs and back to the heart. In *systemic circulation*, blood travels from the heart to tissues and back to the heart. Specialized systemic routes are *coronary circulation*, *portal circulation*, and *fetal circulation*.

CARDIOPULMONARY CIRCULATION

In **cardiopulmonary circulation**, deoxygenated blood returns to the heart through the superior and inferior vena cava to the right atrium, through the tricuspid valve to the right ventricle, through the pulmonary semilunar valve to the pulmonary artery, and finally to the lungs.

The gaseous exchange between carbon dioxide and oxygen takes place in the alveoli of the lungs. Oxygenated blood returns from the lungs through the pulmonary veins to the left atrium, through the bicuspid valve to the left ventricle, through the aortic semilunar valve to the aorta, and then to all parts of the body.

SYSTEMIC CIRCULATION

System circulation has four functions. It circulates chemicals, such as nutrients and oxygen, to tissues and back to the heart. It also carries wastes away from the tissues, helps regulate body temperature, and protects the body from bacteria.

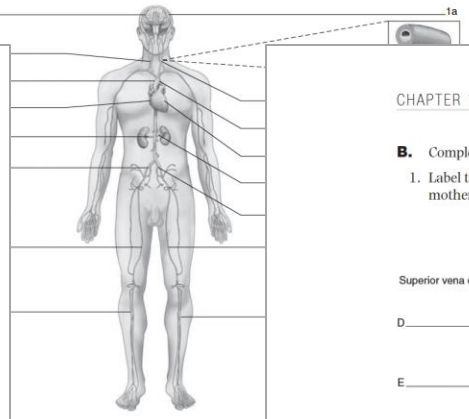
The *aorta*, the largest artery in the body, emerges from the heart, and the first branch, the *coronary artery*, goes to the heart muscle. The aorta artery then forms an arch called the *aortic arch*. Three arterial branches from the aortic arch are the *brachiocephalic*, the *common carotid*, and the *left subclavian arteries*. The aortic arch descends, and many more arteries branch from it; these arteries go to the chest, organs of digestion, reproductive organs, and the rest of the body.

Deoxygenated blood travels through increasing larger veins and empties into either the *superior vena cava* or the *inferior vena cava*, which brings the blood back to the heart.

Coronary Circulation

Two branches of the coronary artery, right and left, come from the aorta. Their branches feed the muscles of the heart. Blood returns to the right atrium through the *coronary sinus*, into which the coronary veins empty.

O. Label the diagram of affected sites and resulting complications of atherosclerosis.



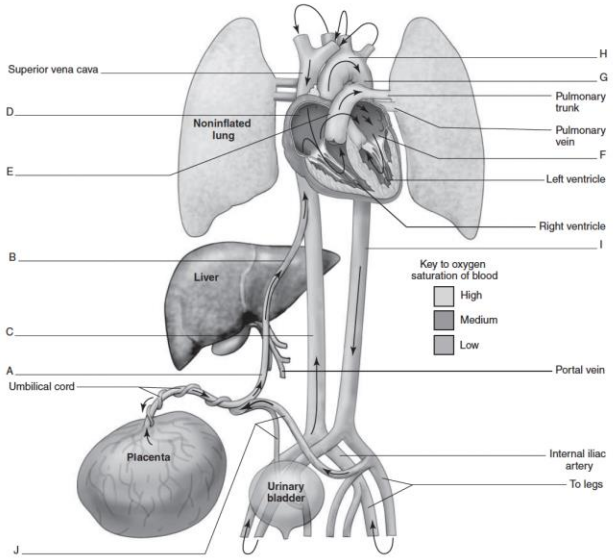
r or symptom in the following list with the

hemiplegia
hypoperfusio
phlebitis
orthostatic hy

f body tissue due to insufficient blood supp
uate blood supply to organs and body syste
is on one side of the body
bility to say what one wishes to say
h, grayish, or greenish discoloration of the
speech or memory
in blood pressure that occurs when rising f
ition
ammation of the lining of a vein

B. Complete the following instructions and answer the question.

1. Label the diagram of fetal circulation from the mother to the heart of the fetus and back to the mother. Trace the flow of blood from the placenta to the umbilical arteries.



2. Describe the function of the ductus venosus, foramen ovale, and ductus arteriosus. Do these structures have a function in the general circulation of the infant at six months of age? Does any blood circulate to the developing lungs of the fetus?

C. Fill in the blanks to complete the following statements.

1. After going through cardiopulmonary circulation, the blood then goes to the major artery, the _____.
2. The first branch is the _____ artery, which takes blood to the _____. The aorta then forms an arch.

APPLYING THEORY TO PRACTICE

1. Prepare a presentation for junior high school students regarding nursing careers, including registered nurses, nurse clinicians, licensed practical nurses, and nurse aides. Describe the educational requirements, the roles, and the future employment possibilities.

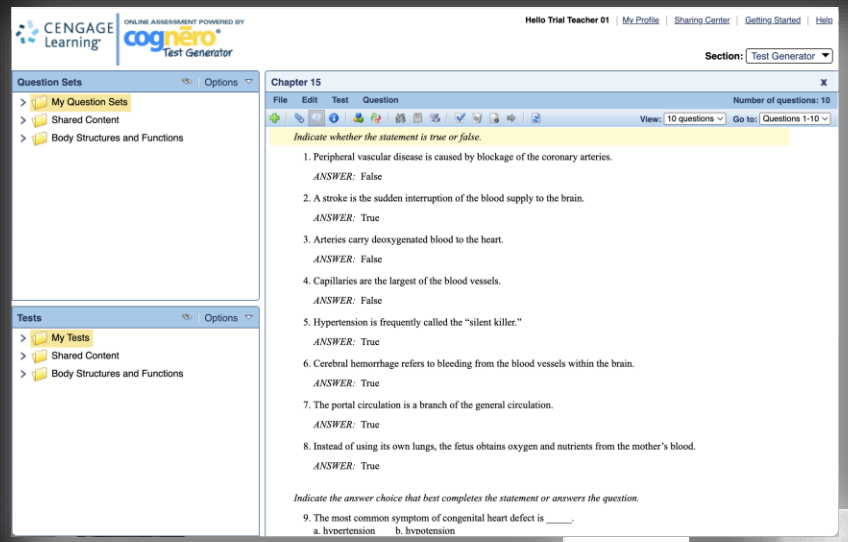
2. Answer the following questions:
   a. Why is hypertension called the "silent killer"?
   b. What risk factors predispose people to hypertension?
   c. What are the complications of hypertension?
   d. How can hypertension be prevented?

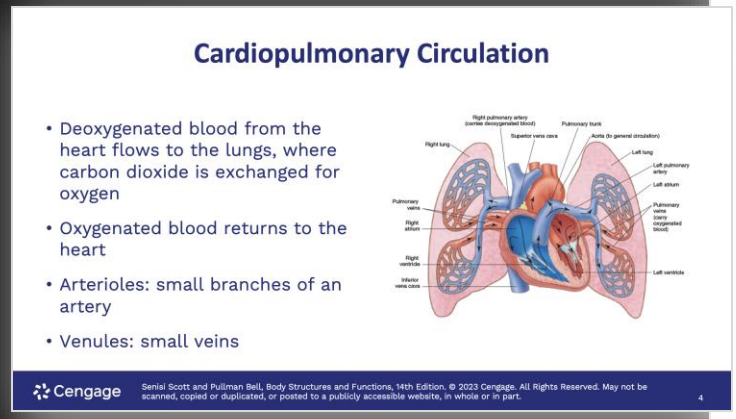
3. You are taking the blood pressure of a patient in the HMO where you are employed. The reading is 150/90. After they have rested for five minutes, you retake their pressure. It is the same. The patient states that it has never been that high. You suspect they may have white-coat hypertension.
   a. Describe white-coat hypertension.

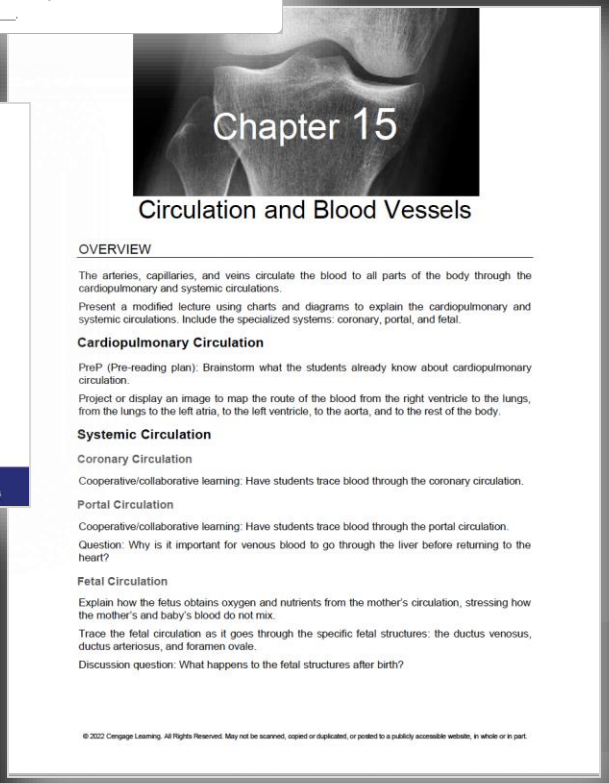
NATIONAL GEOGRAPHIC LEARNING | Cengage

Teacher Resources

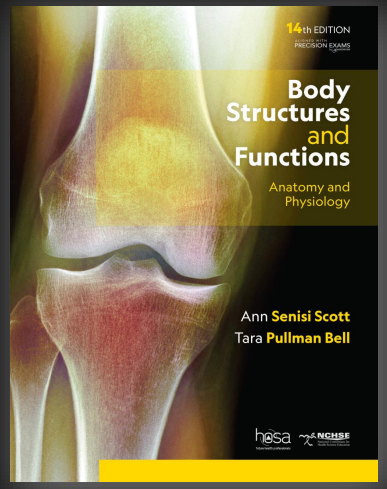
- ✓Instructor's Resource Companion Site
  - ✓Instructor's Manual
  - ✓Educator's Guide
  - ✓Chapter Quizzes
  - ✓Standards Correlations
  - ✓PowerPoint Slides
  - ✓Answer Keys
- ✓Cengage Testing, Powered by Cognero

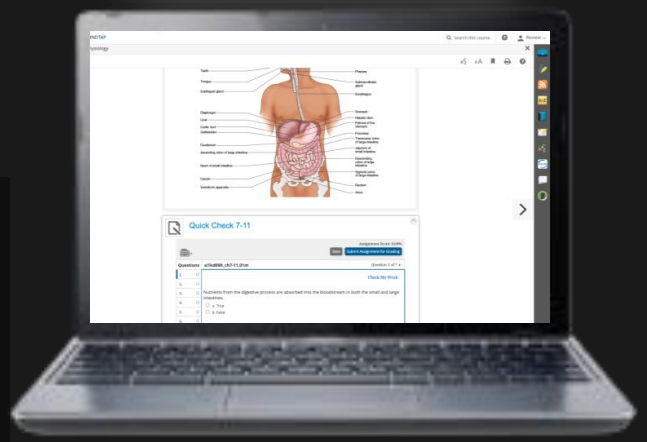






Body Structures and Functions – A Complete Program



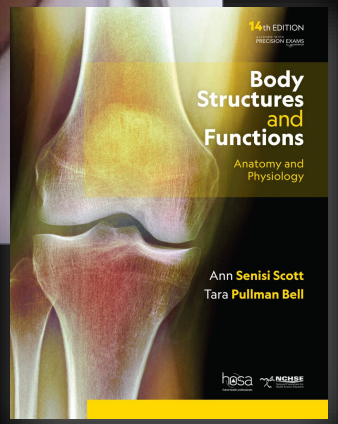


- ✓ Student Edition
- ✓ Print Student Workbook
- ✓ MindTap
- ✓ Cengage Testing, Powered by Cognero
- ✓ Instructor's Resource Companion Site
  - ✓ Instructor's Manual
  - ✓ Educator's Guide
  - ✓ Chapter Quizzes
  - ✓ Standards Correlations
  - ✓ PowerPoint Slides
  - ✓ Answer Keys
- ✓ Cengage Testing, Powered by Cognero

Cengage MindTap

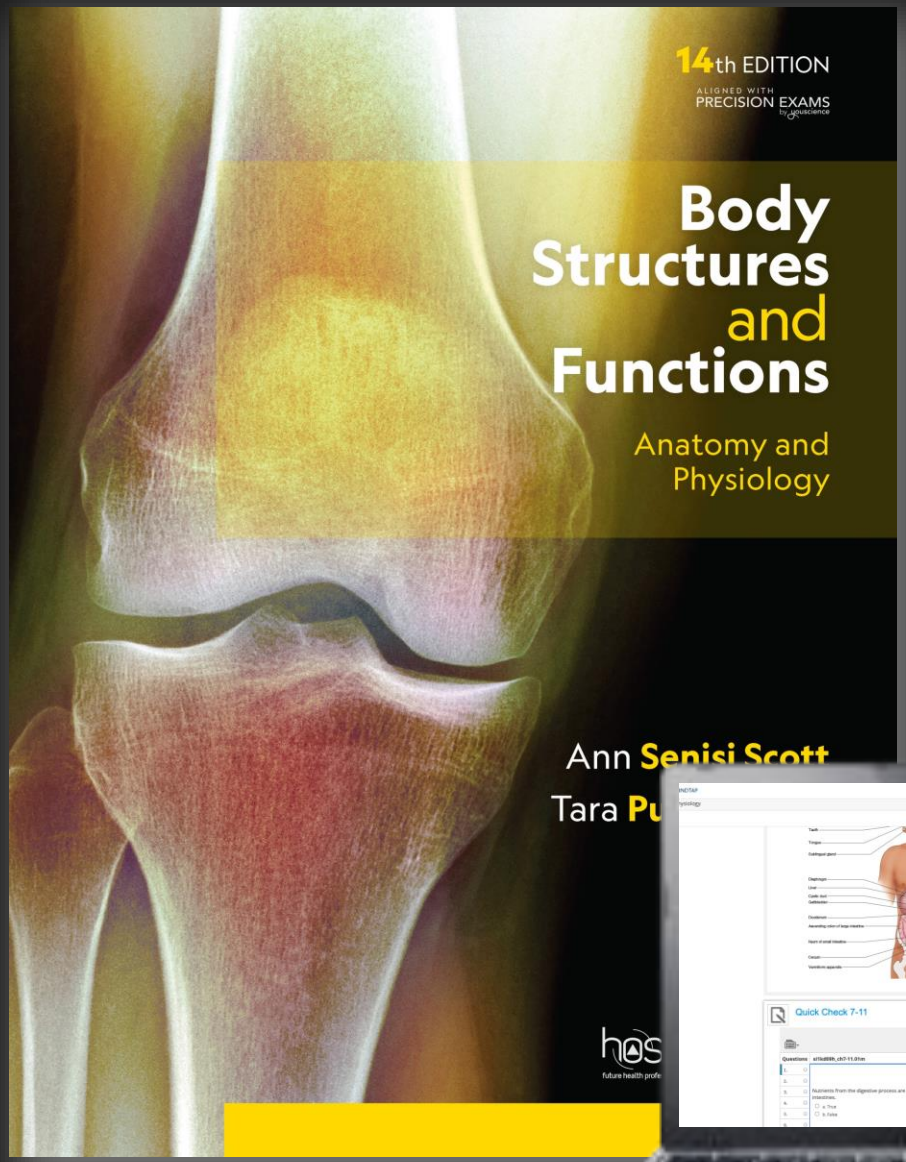
- ✓ Interactive eTextbook with ReadSpeaker
- ✓ Learning Labs Health Care Simulations
- ✓ Formative and Summative Assessment
- ✓ Image Labelling
- ✓ Animations
- ✓ Videos
- ✓ Audio of Terminology
- ✓ Flashcards
- ✓ Study Hub
- ✓ Progress App

Engage · Prepare · Succeed



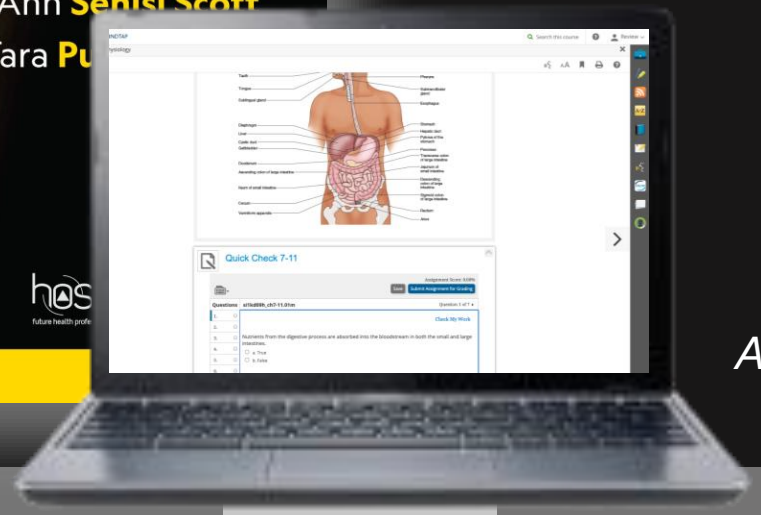
NATIONAL GEOGRAPHIC LEARNING | Cengage

NATIONAL GEOGRAPHIC LEARNING | Cengage



Thank you.

Vote Body Structures for A&P, and let's partner for student success!



ANATOMY AND PHYSIOLOGY