Figure 18.1

Heart Anatomy

(a) Midsternal line
2nd rib
Sternum
Diaphragm
Point of maximal intensity (PMI)

(b) Right lung
Heart

Anterior

Diagram showing heart anatomy with labels:
- Superior vena cava
- Left lung
- Aorta
- Parietal pleura (cut)
- Pulmonary trunk
- Parietal pericardium (cut)
- Apex of heart
- Diaphragm
VENTRICLES

- Pumps blood out of the heart.
  - Right ventricle pumps blood into the pulmonary trunk (PULMONARY CIRCULATION)
  - Left ventricle pumps blood into the aorta (SYSTEMIC CIRCULATION)
Heart valves

– Semilunar valves
  • Situated between the ventricles and the arteries

– Aortic valve
  » Between left ventricle and aorta

– Pulmonary valve
  » Between the right ventricle and pulmonary artery
PULMONARY CIRCULATION
Pathway of Blood Through the Heart and Lungs

Blood from tissues (venous circulation) → right atrium → tricuspid valve → right ventricle → pulmonary semilunar valve → pulmonary arteries → lungs → pulmonary veins → left atrium → bicuspid valve → left ventricle → aortic semilunar valve → aorta → systemic circulation
HEART SOUNDS

• Sounds caused by the sudden closure of the heart valves
• 2 distinct sounds can be heard during each cardiac cycle
  – “LUB” and “DUB”
HEART CONDUCTING SYSTEM

1. Sinoatrial (SA) Node
2. Atrioventricular (AV) Node
3. Atrioventricular (AV) Bundle (Bundle of His)
4. Right and Left Bundle Branches
5. Purkinje Fibers

Anterior view of frontal section
EXTRINSIC CONTROL OF HEART FUNCTION

• Extrinsic ~ outside

• Cardiovascular centres
  – Control heart functions
  – Located in the medulla oblongata (brain stem)
  – Sympathetic nerves from these centres increase heart function
  – Parasympathetic nerves from these centres decrease heart function
Arteries and arterioles

- Made up of 3 layers
  - Tunica **internal**
    - A layer of endothelial cells and a band of elastic tissue
  - Tunica **media**
    - Made up of *smooth muscle* plus elastic tissue
    - Ability to *expand* (during systole) and *recoil* (during diastole)
  - Tunica **external**
    - Made up of *fibro-elastic* tissue
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Factors affecting venous return

– The ‘muscle pump’
  • Contraction of muscles, especially those in the legs, squeezes the veins between them
    – Forces blood thru valves towards the heart
– The ‘respiratory pump’
  • The negative pressure inside the thorax during inspiration (breathing in) tends to suck blood into the thorax (where the heart is located).
Peripheral Resistance

• Usually depends on the diameter (lumen) of the arterioles

• The smooth muscle in the arterioles constrict to cause the diameter of the arterioles to become smaller

  – The peripheral resistance then increases accordingly

  – BP is increased
Peripheral Resistance

• The smooth muscle is under the control of the sympathetic nervous system
  – Vasomotor centre is located in the medulla (brain stem)
• (NOTE: NO parasympathetic nerves to the blood vessels)
• Certain chemicals can also cause contraction of the smooth muscles: adrenalin, noradrenaline, histamine and other hormones
Regulation of Blood pressure

- Changes in BP, CO$_2$, and O$_2$ levels cause autonomic reflexes to maintain BP within normal range

- **Kidneys** also important role in maintaining BP by regulating plasma volume and consequently the blood volume
Vessel Diameter

**Vasomotor Fibers**

- **Constriction** of blood vessels increases **PR** and **BP**
- Vessel diameter is actively regulated by vasomotor fibers, **sympathetic** nerve fibers that innervate the vessel's smooth muscle layer.
- Vasomotor fibers release norepinephrine (noradrenalin), a powerful **vasoconstrictor**.
- Other vasoconstrictors:
  - Epinephrine (adrenalin), Angiotensin II, Vasopressin (ADH)
Coronary artery bypass grafting (CABG)