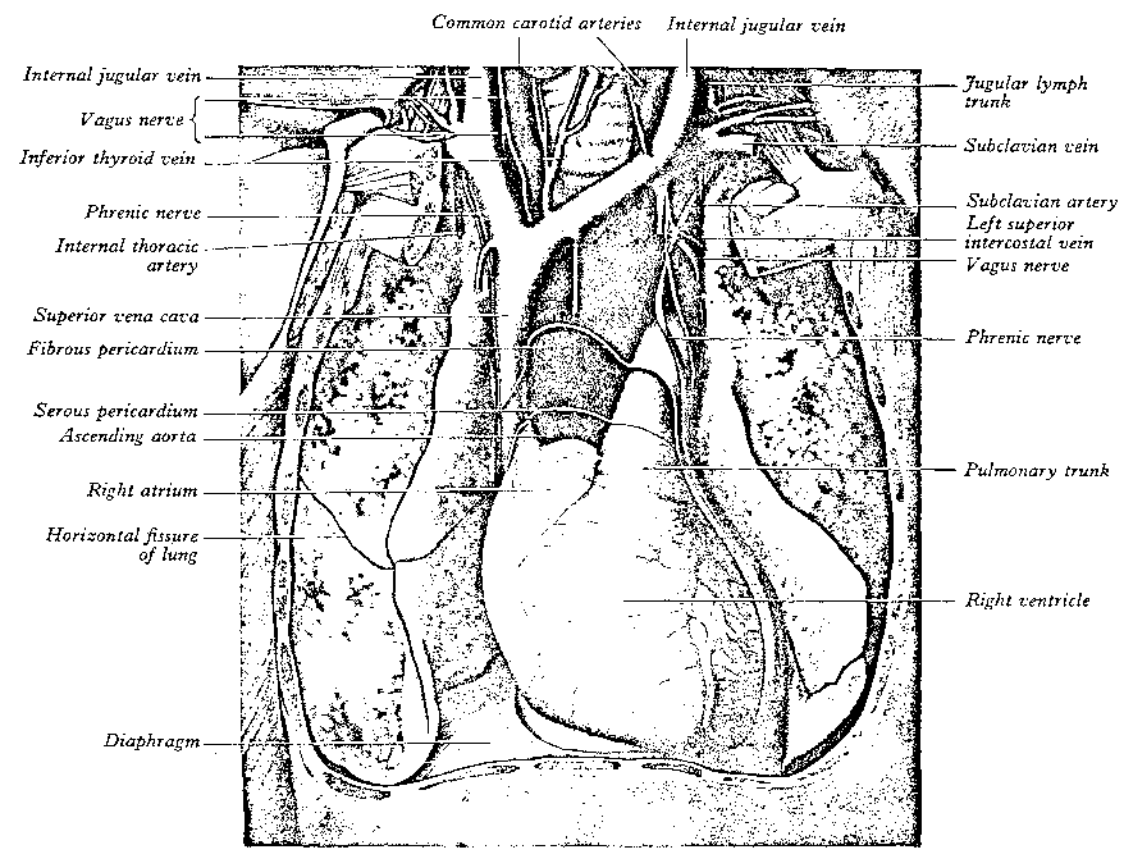
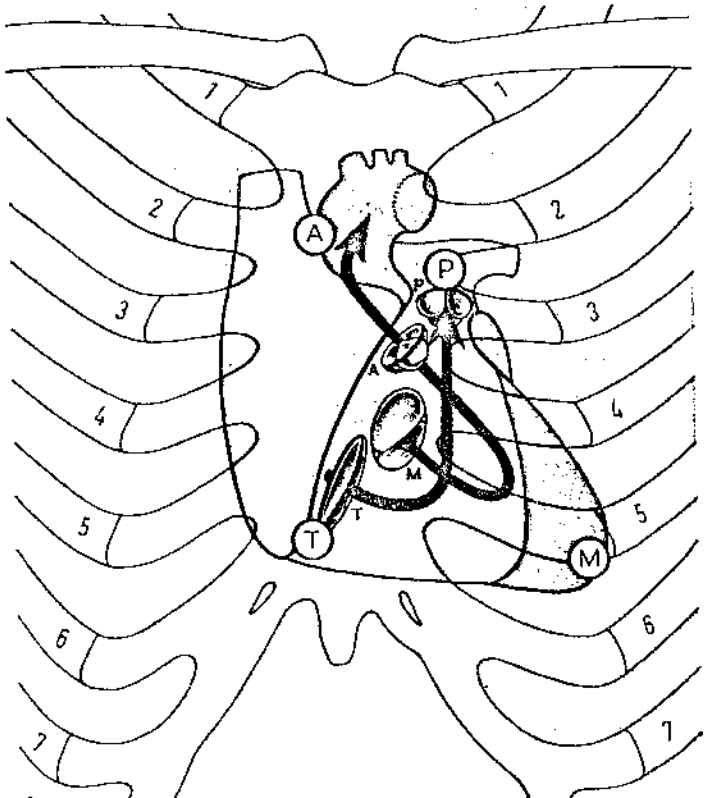
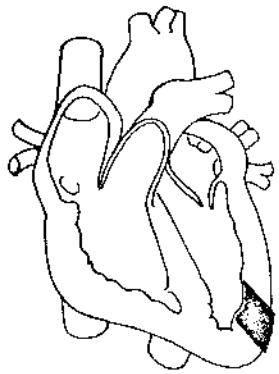
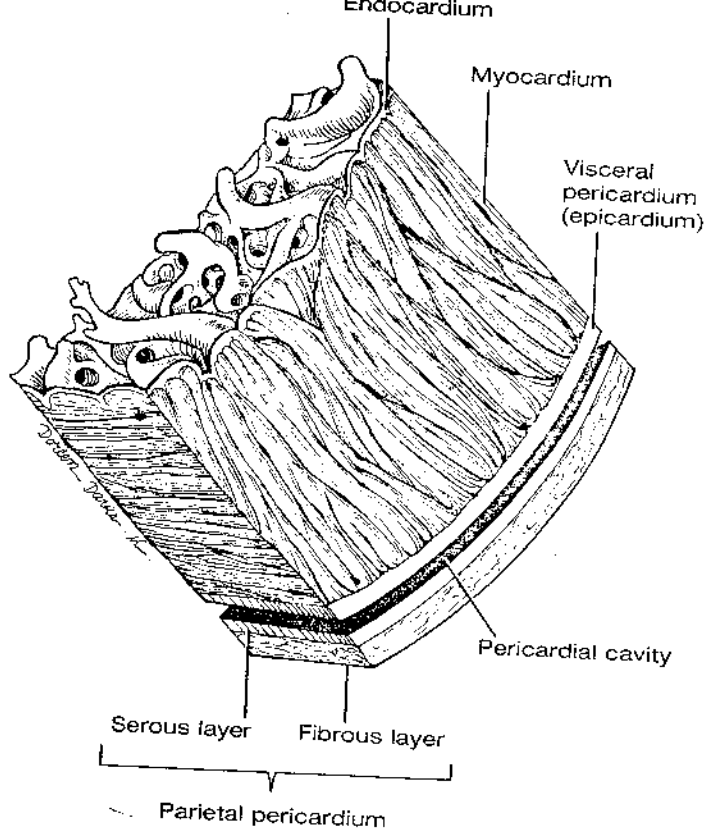
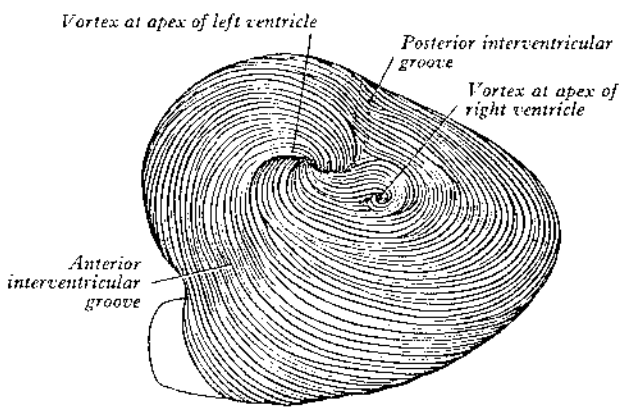
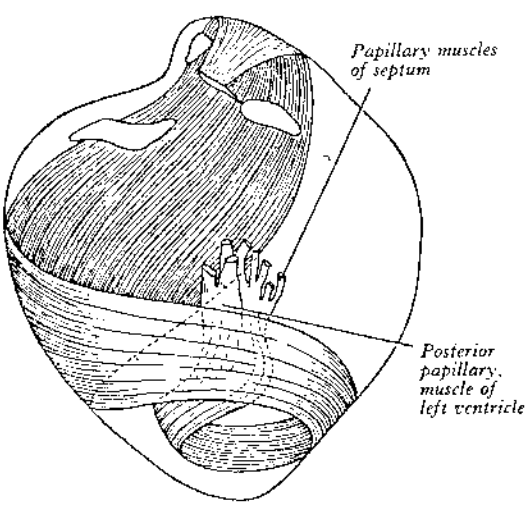

Common carotid arteries
Internal jugular vein
Internal jugular vein
Vagus nerve
Inferior thyroid vein
Phrenic nerve
Internal thoracic artery
Superior vena cava
Fibrous pericardium
Serous pericardium
Ascending aorta
Right atrium
Horizontal fissure of lung
Diaphragm
Jugular lymph trunk
Subclavian vein
Subclavian artery
Left superior intercostal vein
Vagus nerve
Phrenic nerve
Pulmonary trunk
Right ventricle

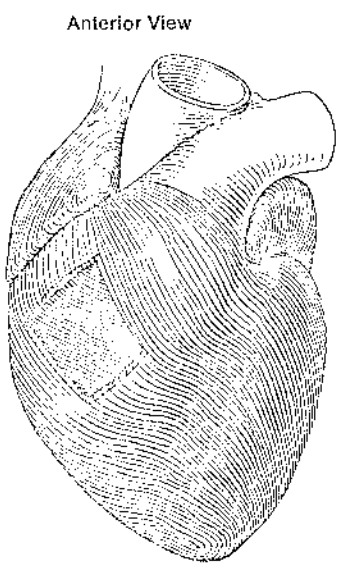

1
2
3
4
5
6
7
A
P
M
T

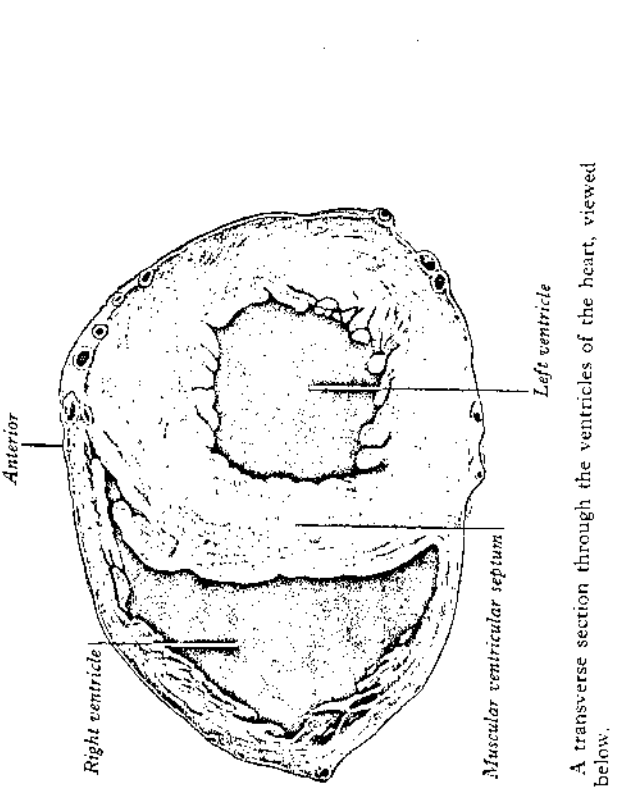


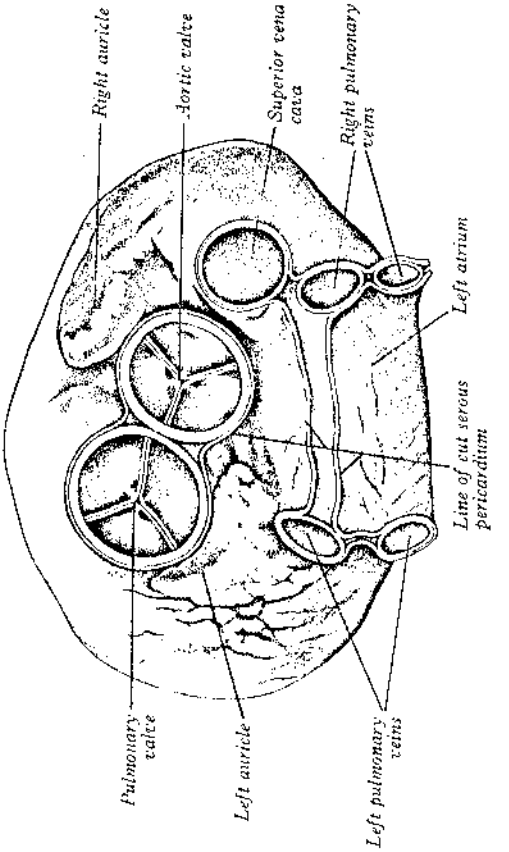

Endocardium
Myocardium
Visceral pericardium (epicardium)
Pericardial cavity
Serous layer
Fibrous layer
Parietal pericardium


Vortex at apex of left ventricle
Posterior interventricular groove
Vortex at apex of right ventricle
Anterior interventricular groove

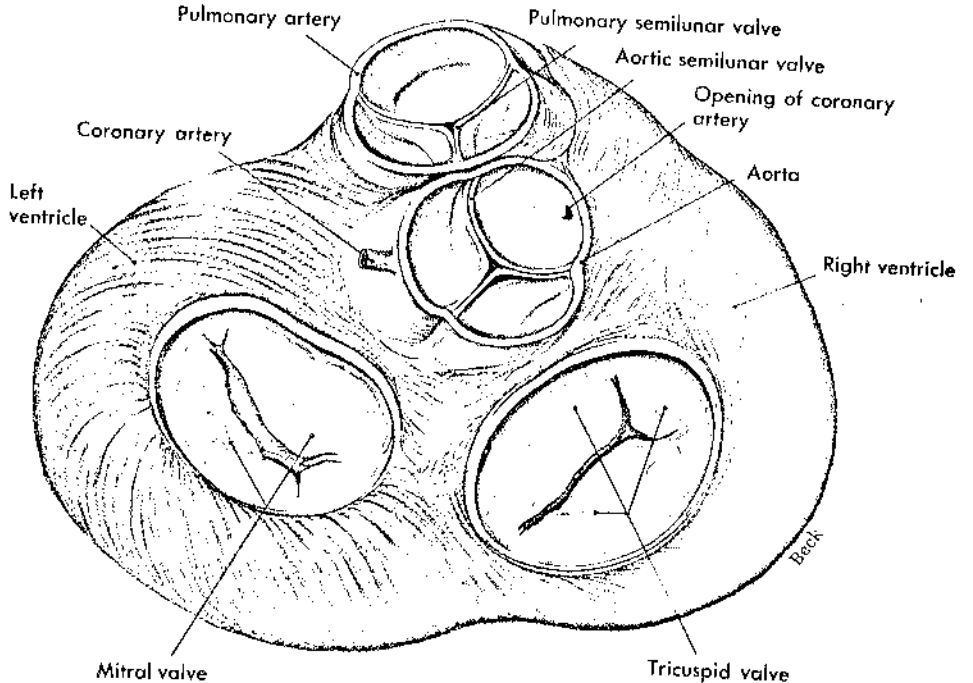

Papillary muscles of septum
Posterior papillary muscle of left ventricle

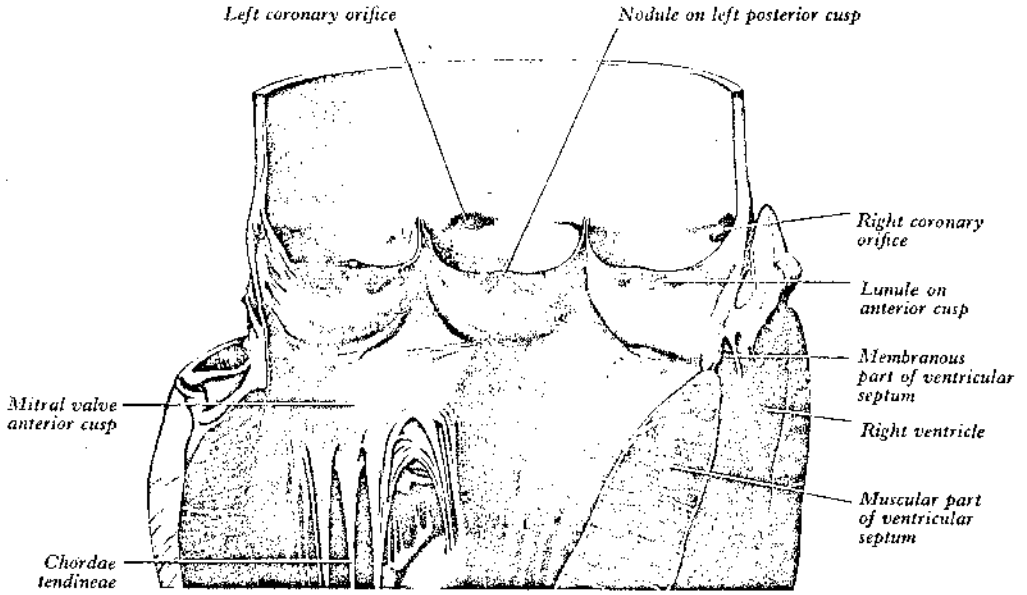

Anterior View

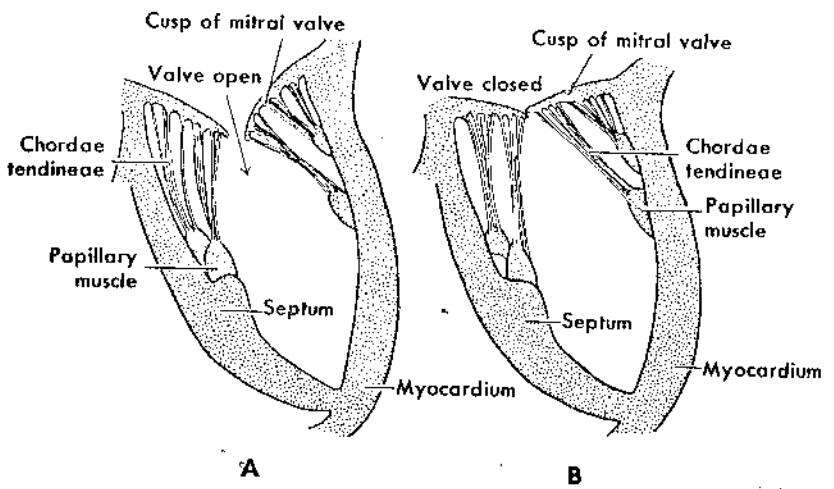


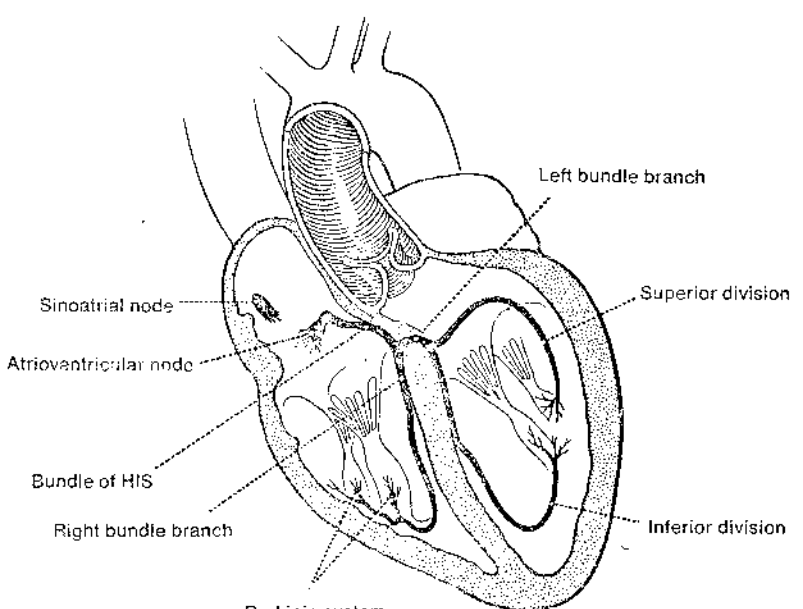


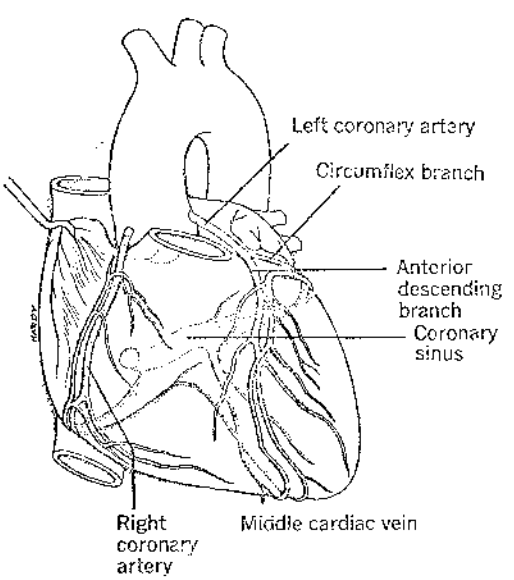
6.19 A transverse section through the ventricles of the heart, viewed from below.



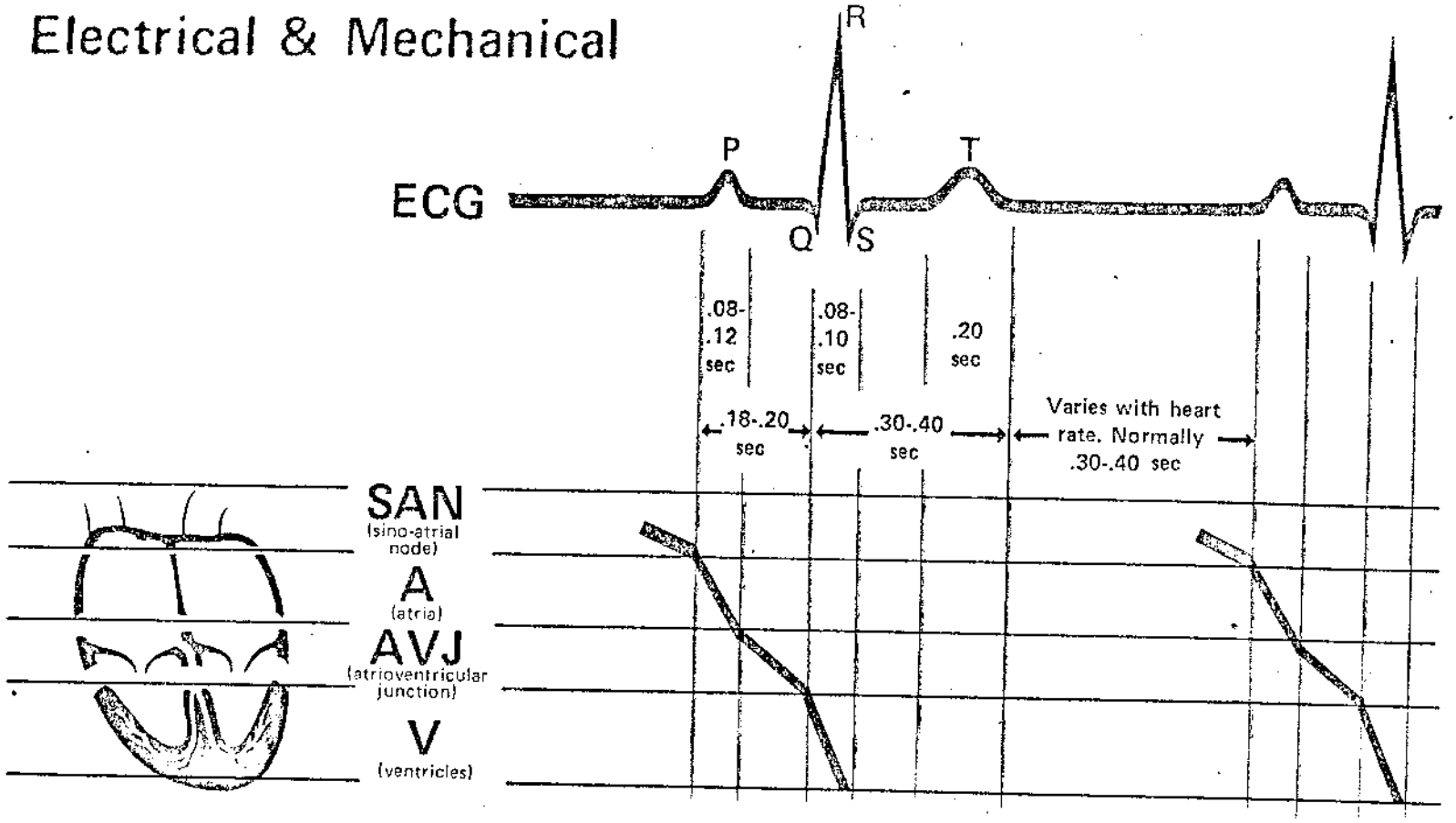

Left coronary orifice
Nodule on left posterior cusp
Right coronary orifice
Lunule on anterior cusp
Membranous part of ventricular septum
Right ventricle
Muscular part of ventricular septum
Mitral valve anterior cusp
Chordae tendineae

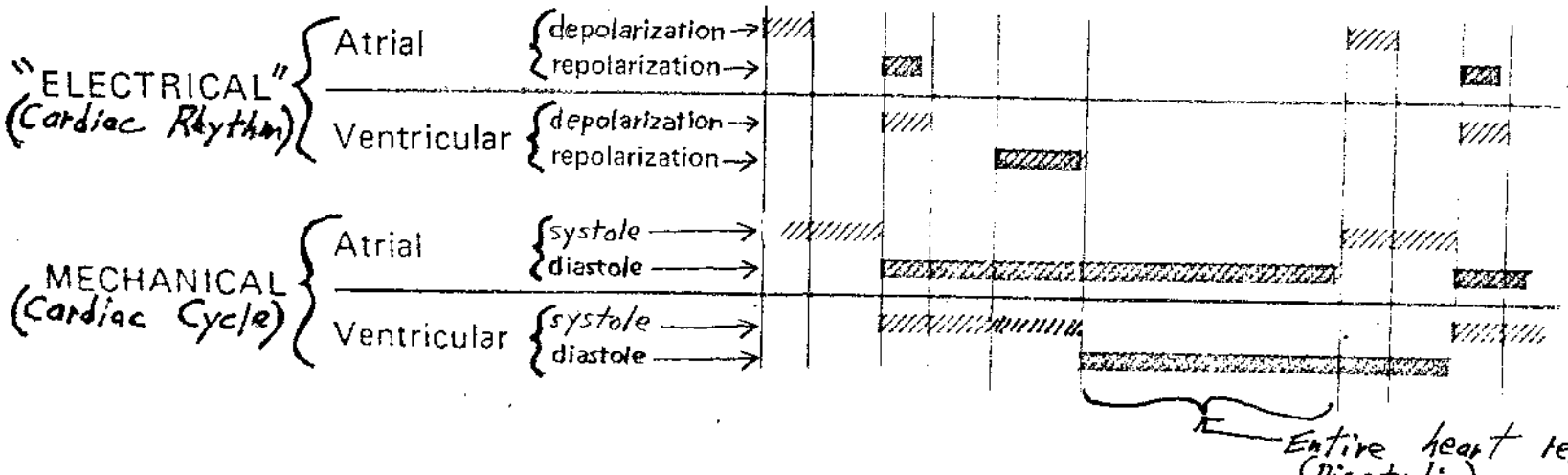

Cusp of mitral valve
Valve open
Chordae tendineae
Papillary muscle
Septum
Myocardium
A
Cusp of mitral valve
Valve closed
Chordae tendineae
Papillary muscle
Septum
Myocardium
B


Left bundle branch
Superior division
Sinoatrial node
Atrioventricular node
Bundle of HIS
Right bundle branch
Inferior division
Purkinje system


Left coronary artery
Circumflex branch
Anterior descending branch
Coronary sinus
Right coronary artery
Middle cardiac vein

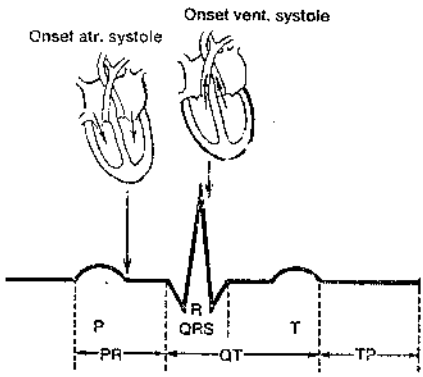
"Normal" Activity of the Heart—
Electrical & Mechanical





Summary of the Events of the Cardiac Cycle and "Sectical" rhythm

1. Cycle initiated by tonic discharge of the SA node.
2. Depolarization spreads over atrial muscle.
3. P wave of electrocardiogram (ECG), 0.08 sec.
4. Ejection of blood into ventricles. Contraction of atria—P-R interval of ECG, 0.1 sec.
5. Depolarization stimulus arrives at AV node and spreads rapidly through bundle of His and Purkinje fibers.
6. Atrial contraction ends—relaxation begins—lasts 0.7 sec.
7. QRS complex developed, 0.08 sec.
8. Contraction of ventricles begin.
9. T wave of ECG, repolarization begins.
10. Ventricular contraction ends—Q-T interval of ECG, 0.3 sec.
11. Ventricular relaxation begins, lasts 0.5 sec.
12. Overlap of ventricular relaxation and atrial relaxation—T-P interval of ECG—0.4 sec; called cardiac pause.
13. Cycle repeats; total cycle time 0.8 sec.



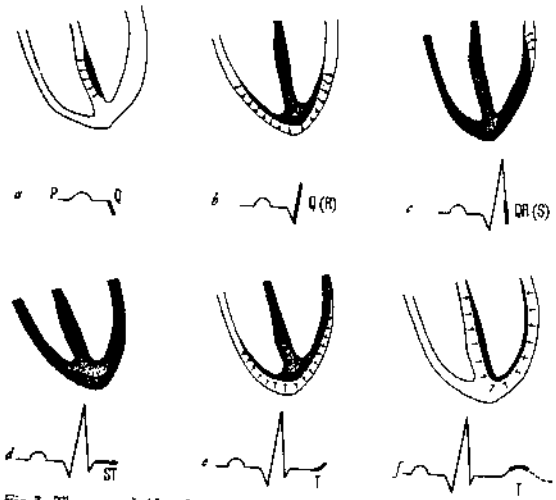
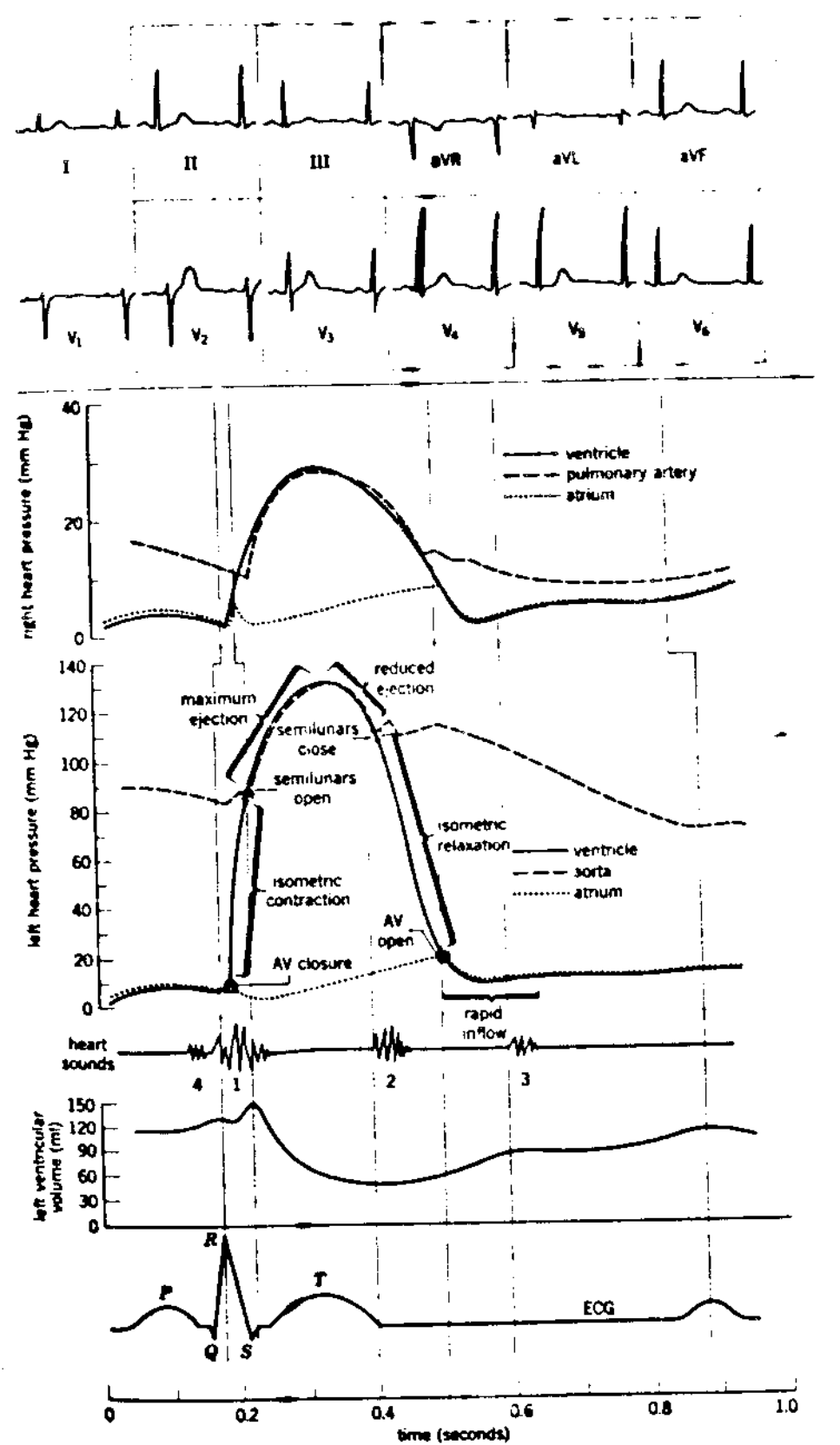
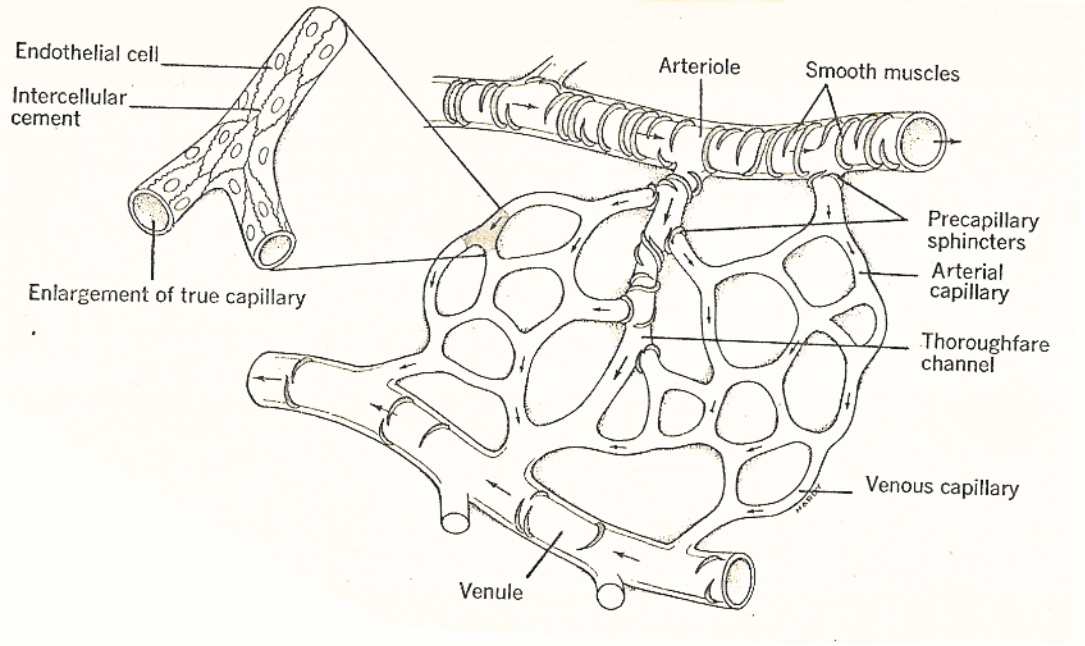


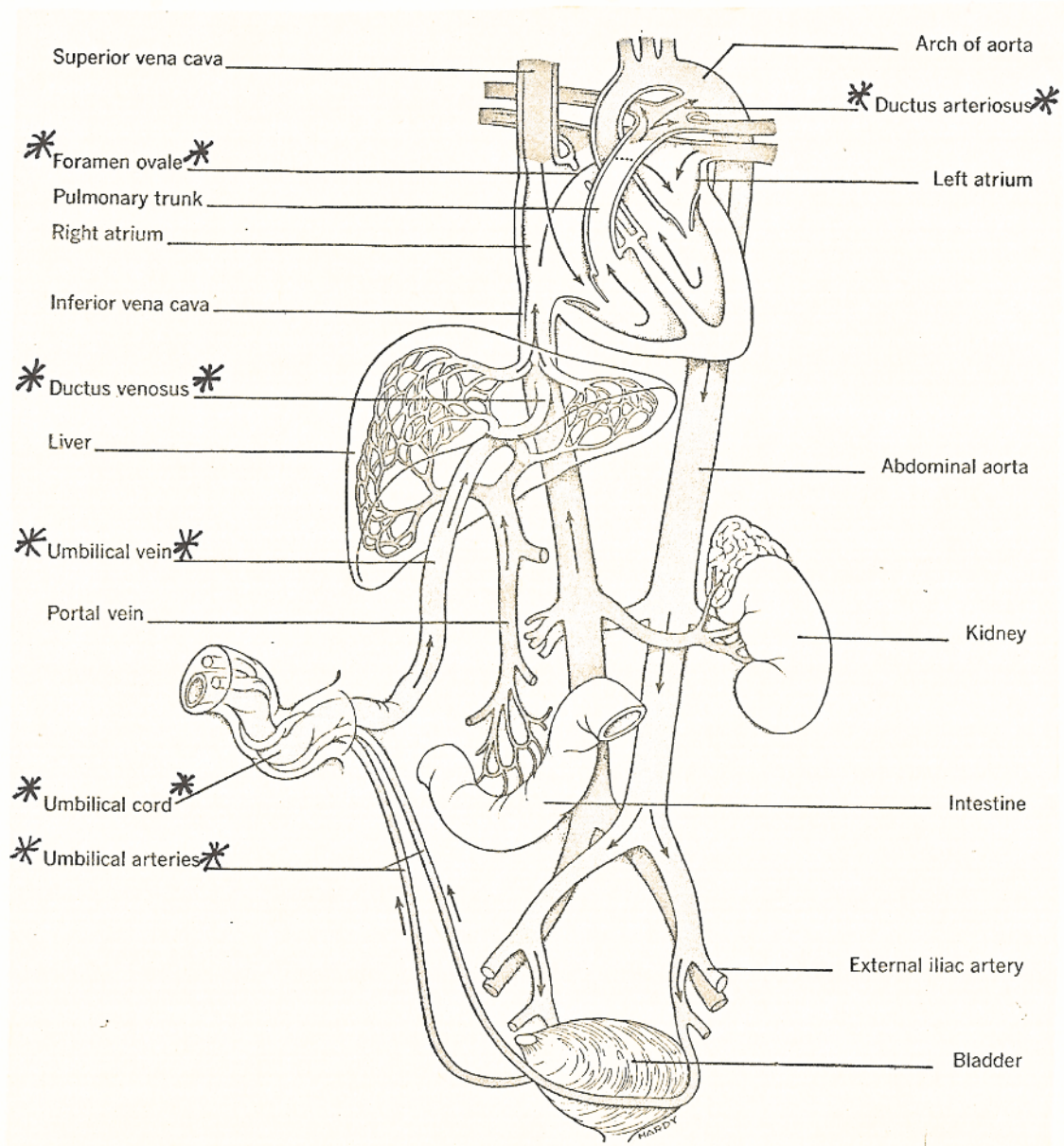
Fig. 3. The spread (depolarization) and regression (repolarization) of activation in the ventricular muscle and their relationship to the ECG. (Modified from RUSHMER.)

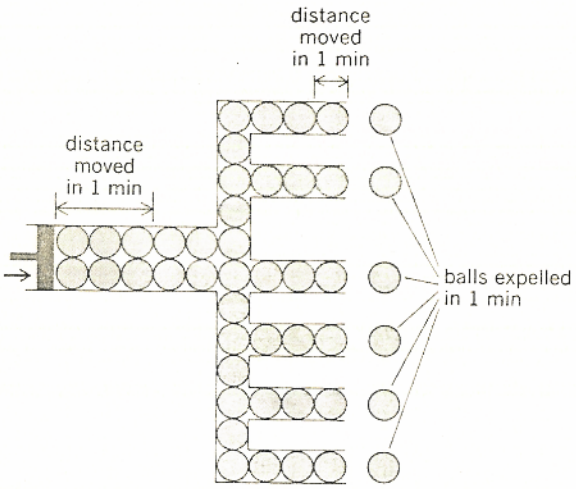
Ventricular depolarization (ECG: QRS complex). *a* Depolarization of the atria (ECG: P complete; repolarization [T_a] in process [not shown]). Commencement of ventricular depolarization in the left part of the septum (ECG: Q). Commencement of ventricular systole. *b* Spread of the impulse from the endocardium to the epicardium and apex; septum completely depolarized (ECG: Q and first part of R). *c* Spread of activation almost complete except in the basal region of the left ventricular wall (ECG: terminal part of R). *d* Ventricular muscle completely depolarized; no action current (ECG: ST).

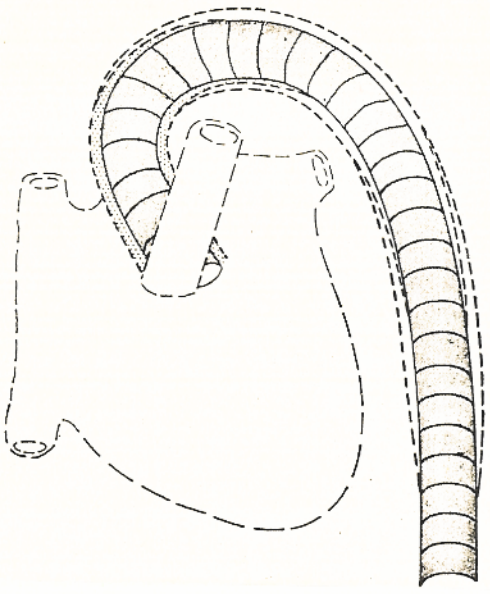
Ventricular repolarization (ECG: T wave). *e* Initial repolarization in the epicardial layers (ECG: start of T). *f* Repolarization almost complete except in the endocardial layers of the left ventricle, the last to be repolarized (ECG: middle part of T). After complete repolarization the ventricular muscle is contracted and ventricular systole ended.

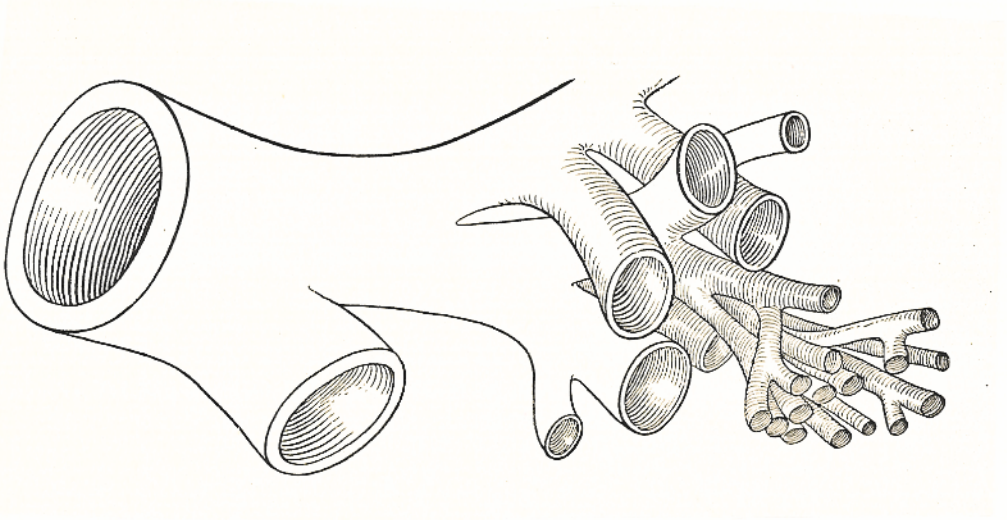

I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6
right heart pressure (mm Hg)
40
20
0
ventricle
pulmonary artery
atrium
left heart pressure (mm Hg)
140
120
100
80
60
40
20
0
maximum ejection
reduced ejection
semilunars close
semilunars open
isometric relaxation
isometric contraction
AV open
AV closure
ventricle
aorta
atrium
rapid inflow
heart sounds
4
1
2
3
left ventricular volume (ml)
150
120
90
60
30
0
R
P
T
Q
S
ECG
0
0.2
0.4
0.6
0.8
1.0
time (seconds)

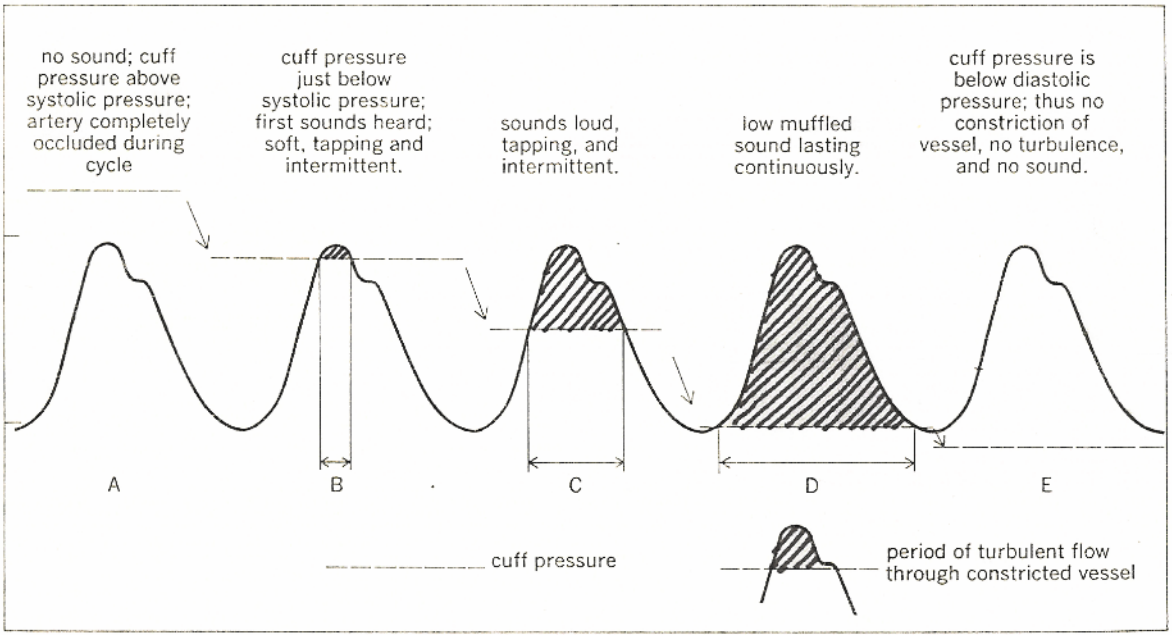

Endothelial cell
Intercellular cement
Enlargement of true capillary
Arteriole
Smooth muscles
Precapillary sphincters
Arterial capillary
Thoroughfare channel
Venous capillary
Venule

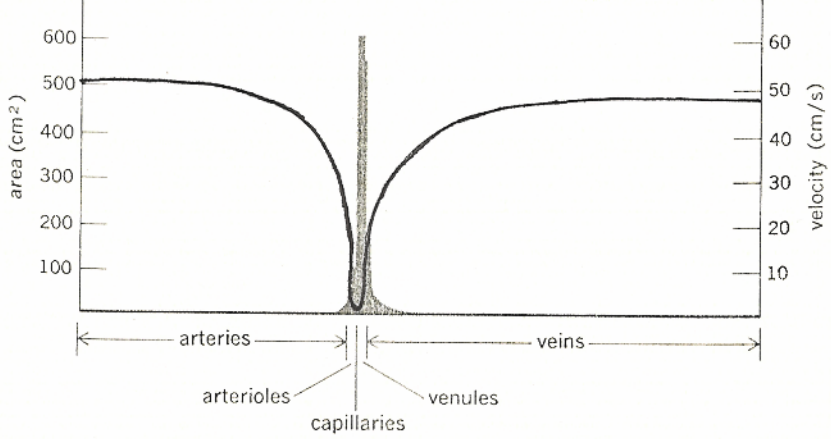

Superior vena cava
Arch of aorta
Ductus arteriosus
Foramen ovale
Left atrium
Pulmonary trunk
Right atrium
Inferior vena cava
Ductus venosus
Liver
Abdominal aorta
Umbilical vein
Portal vein
Kidney
Umbilical cord
Intestine
Umbilical arteries
External iliac artery
Bladder

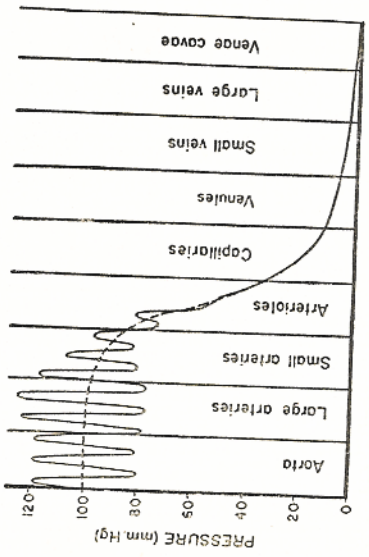

distance moved in 1 min
distance moved in 1 min
balls expelled in 1 min

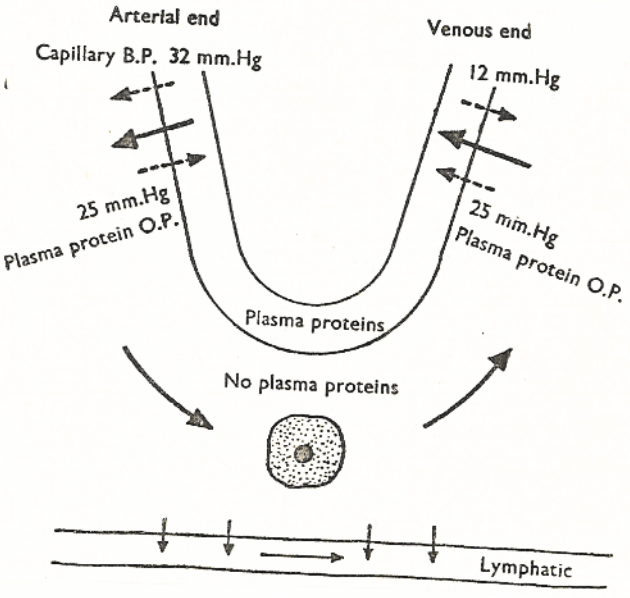


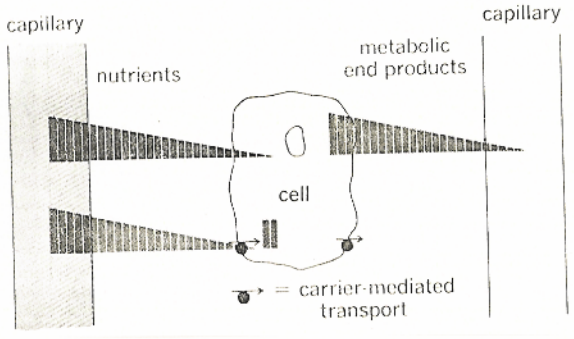


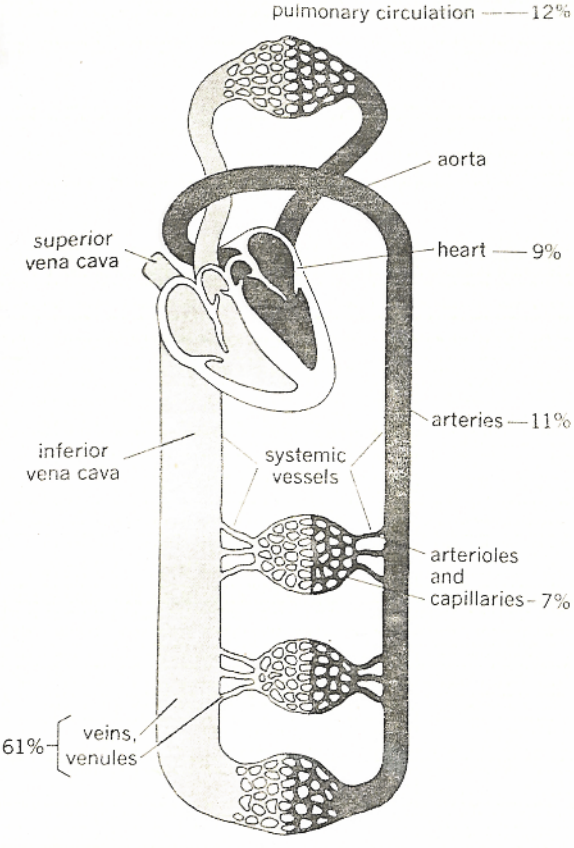

no sound; cuff pressure above systolic pressure; artery completely occluded during cycle
cuff pressure just below systolic pressure; first sounds heard; soft, tapping and intermittent.
sounds loud, tapping, and intermittent.
low muffled sound lasting continuously.
cuff pressure is below diastolic pressure; thus no constriction of vessel, no turbulence, and no sound.
pressure (mm Hg)
120
80
A
B
C
D
E
cuff pressure
period of turbulent flow through constricted vessel

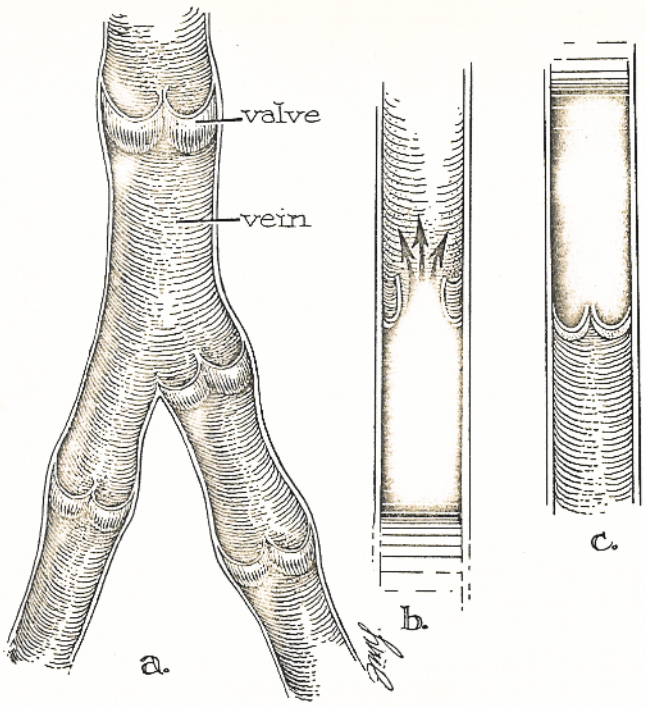

area (cm²)
600
500
400
300
200
100
velocity (cm/s)
60
50
40
30
20
10
arteries
veins
arterioles
venules
capillaries

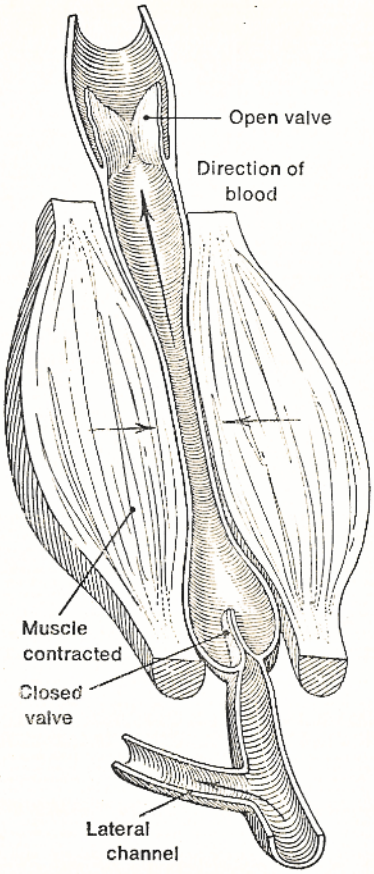

Aorta
Large arteries
Small arteries
Arterioles
Capillaries
Venules
Small veins
Large veins
Venae cavae
PRESSURE (mm.Hg)
120
100
80
60
40
20
0

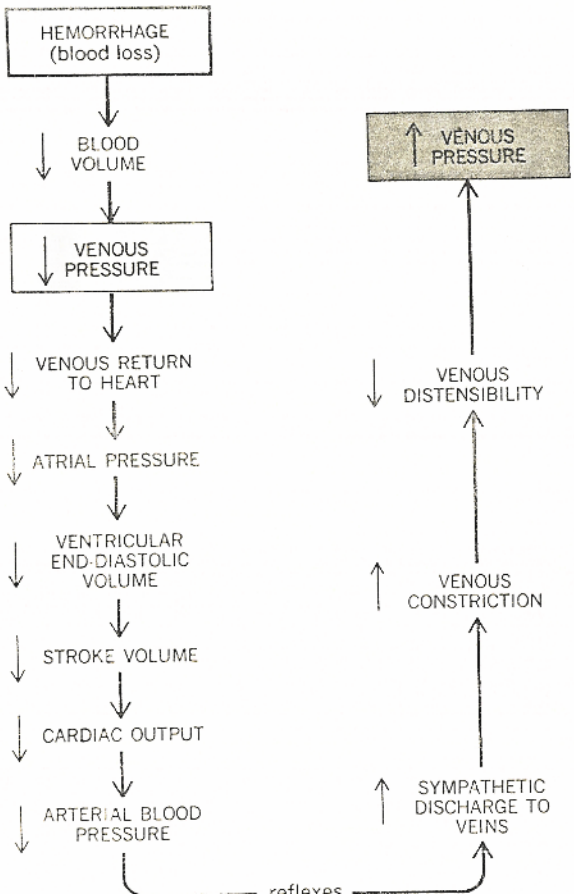

Arterial end
Capillary B.P. 32 mm.Hg
25 mm.Hg
Plasma protein O.P.
Venous end
12 mm.Hg
25 mm.Hg
Plasma protein O.P.
Plasma proteins
No plasma proteins
Lymphatic

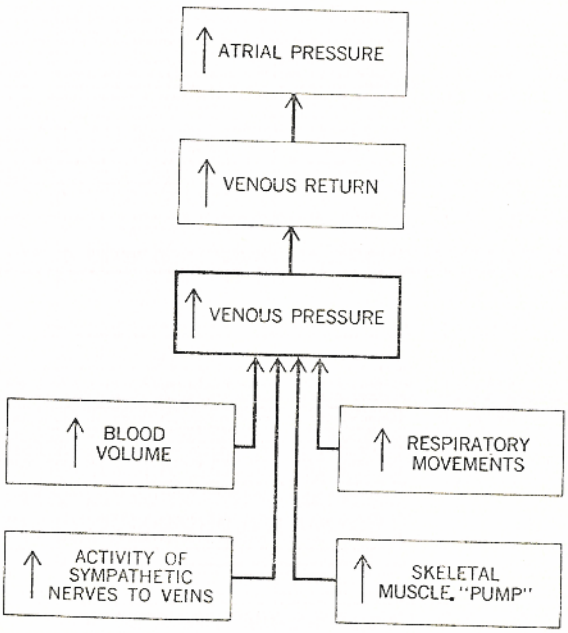

capillary
nutrients
metabolic
end products
capillary
cell
= carrier-mediated
transport

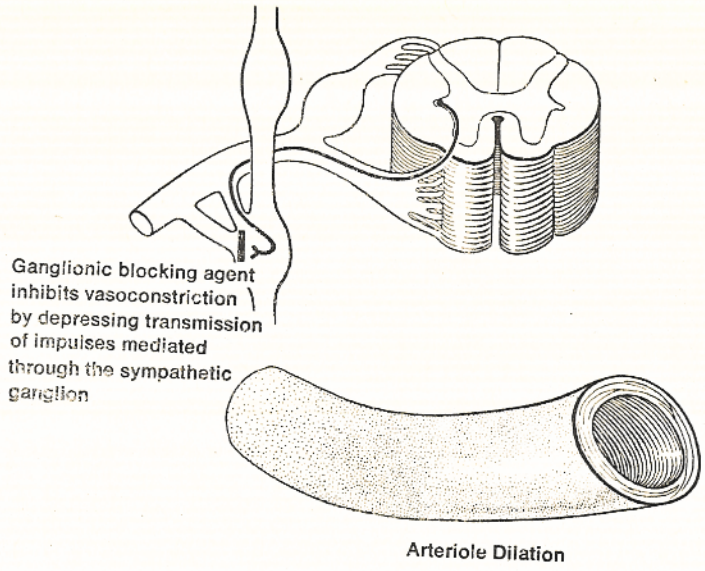

pulmonary circulation — 12%
aorta
superior
vena cava
heart — 9%
arteries — 11%
inferior
vena cava
systemic
vessels
arterioles
and
capillaries — 7%
61%
veins,
venules

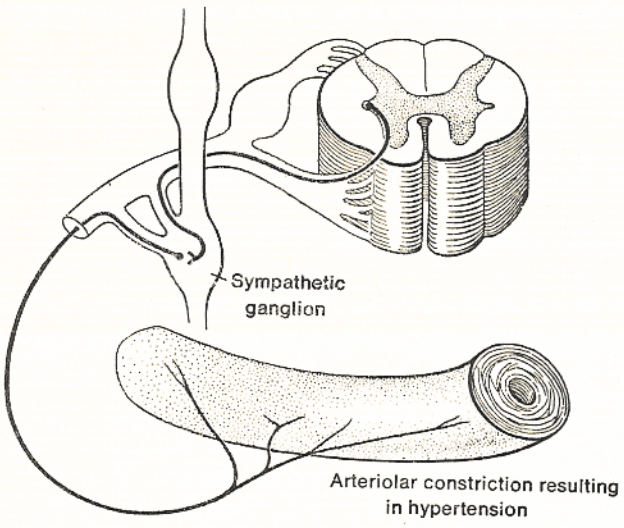

valve
vein
a.
b.
c.

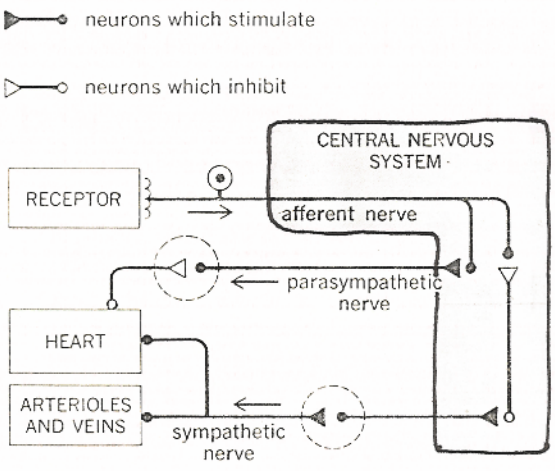

Open valve
Direction of blood
Muscle contracted
Closed valve
Lateral channel

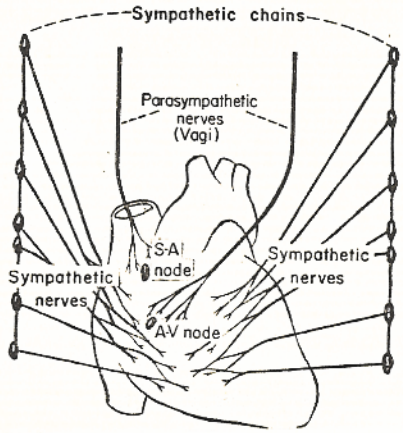

HEMORRHAGE (blood loss)
BLOOD VOLUME
VENOUS PRESSURE
VENOUS RETURN TO HEART
ATRIAL PRESSURE
VENTRICULAR END-DIASTOLIC VOLUME
STROKE VOLUME
CARDIAC OUTPUT
ARTERIAL BLOOD PRESSURE
reflexes
SYMPATHETIC DISCHARGE TO VEINS
VENOUS CONSTRICTION
VENOUS DISTENSIBILITY
VENOUS PRESSURE

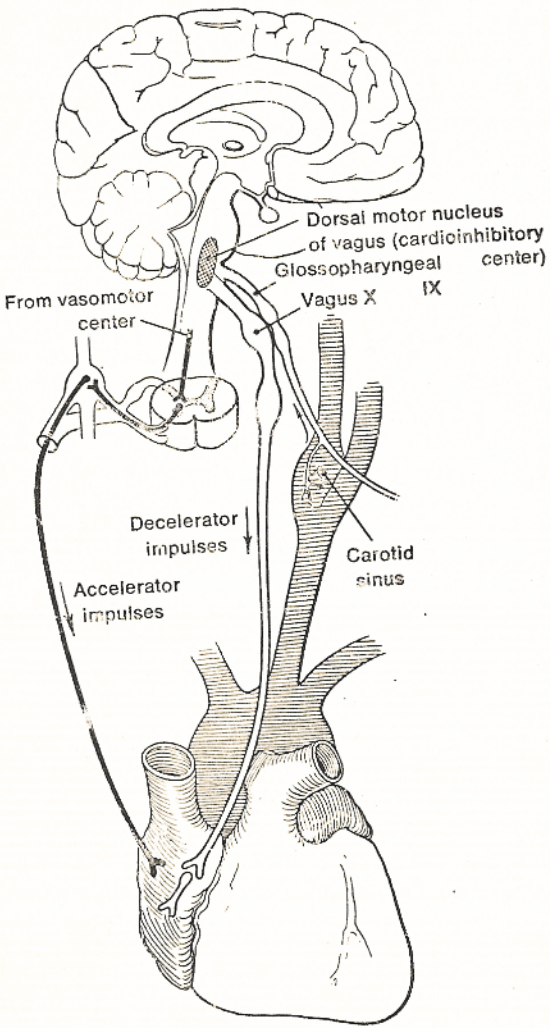

ATRIAL PRESSURE
VENOUS RETURN
VENOUS PRESSURE
BLOOD VOLUME
RESPIRATORY MOVEMENTS
ACTIVITY OF SYMPATHETIC NERVES TO VEINS
SKELETAL MUSCLE "PUMP"

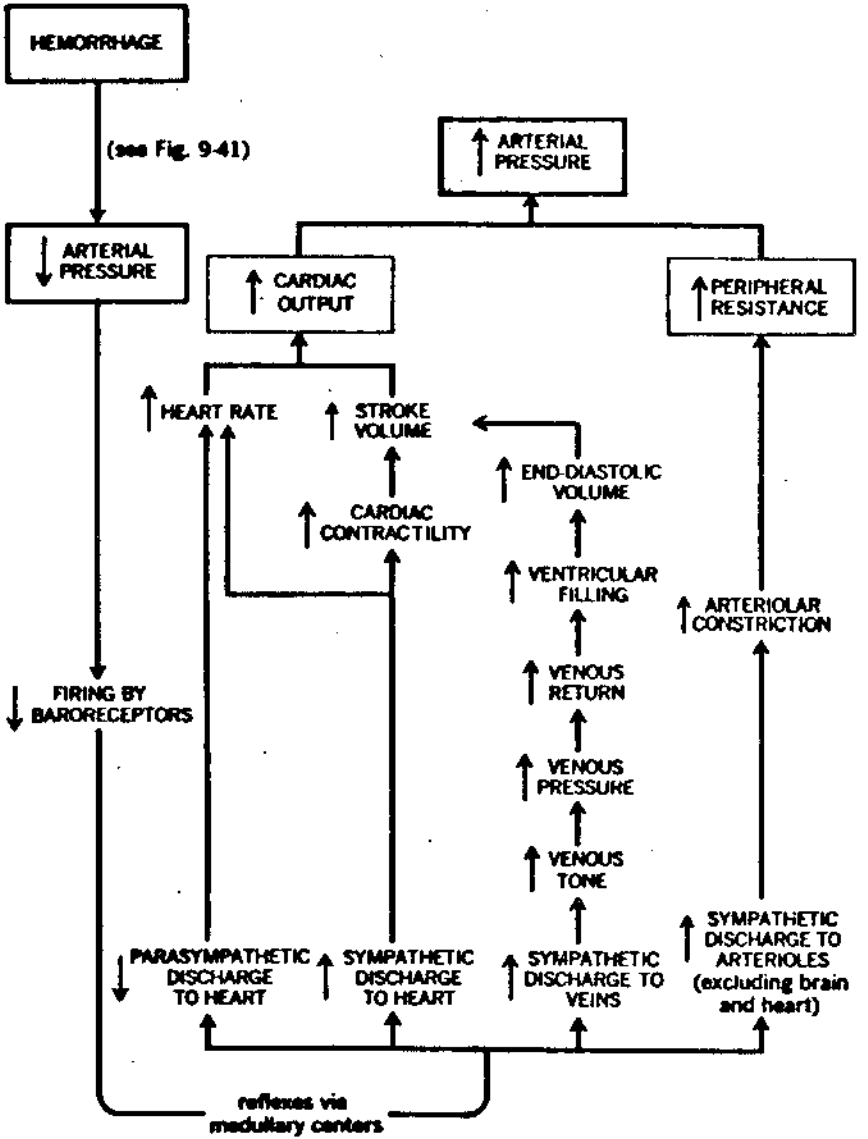

Ganglionic blocking agent inhibits vasoconstriction by depressing transmission of impulses mediated through the sympathetic ganglion
Arteriole Dilation


Sympathetic ganglion
Arteriolar constriction resulting in hypertension

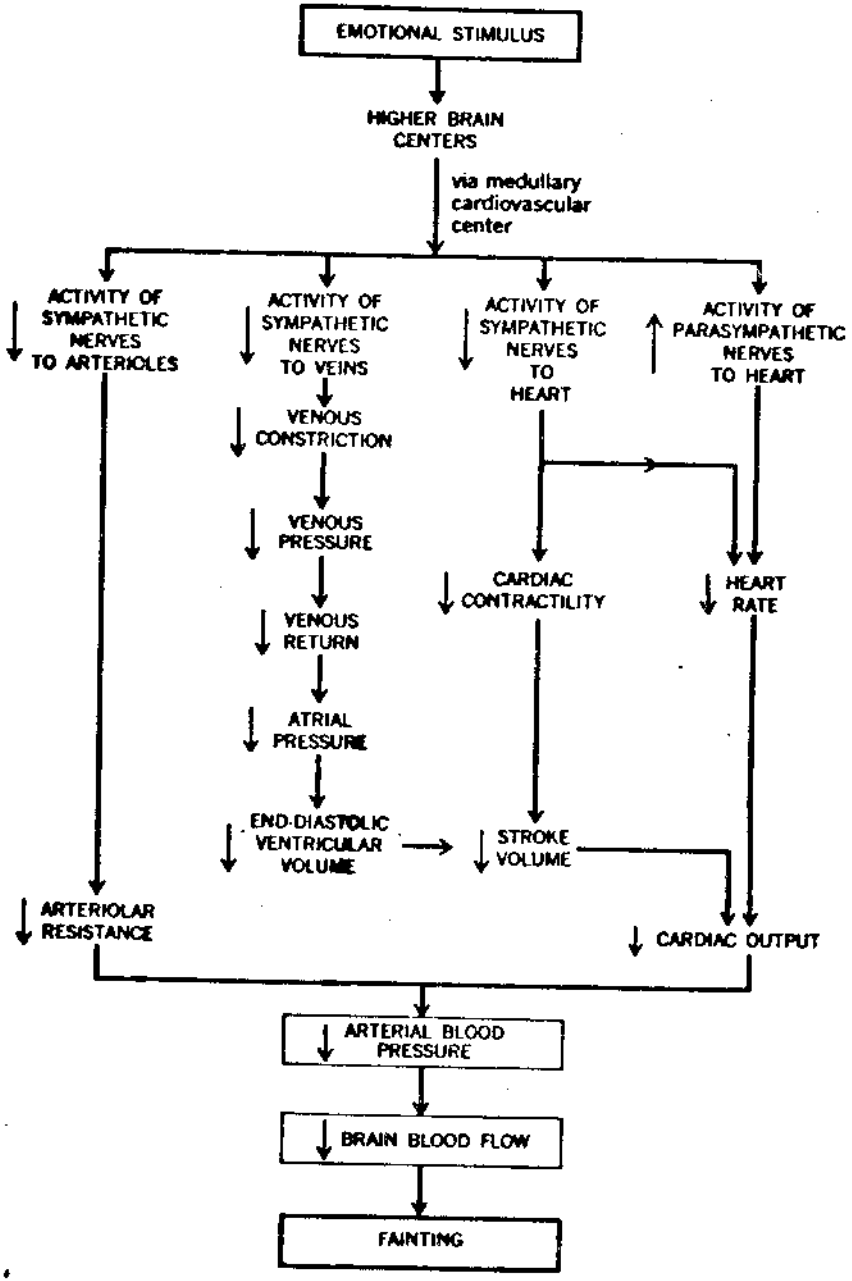

neurons which stimulate
neurons which inhibit
CENTRAL NERVOUS SYSTEM
RECEPTOR
afferent nerve
parasympathetic nerve
HEART
ARTERIOLES AND VEINS
sympathetic nerve


Sympathetic chains
Parasympathetic nerves (Vagi)
S-A node
Sympathetic nerves
Sympathetic nerves
A-V node


Dorsal motor nucleus of vagus (cardioinhibitory center)
Glossopharyngeal IX
Vagus X
From vasomotor center
Deceleratorimpulses
Accelerator impulses
Carotid sinus

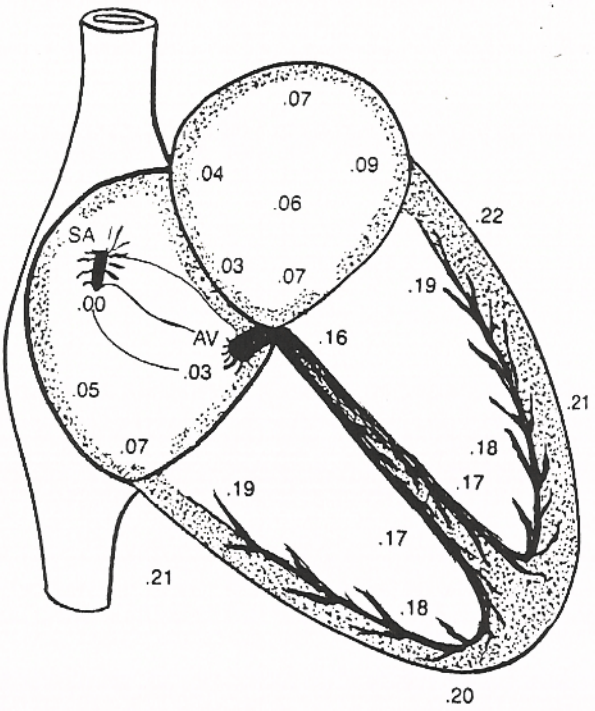


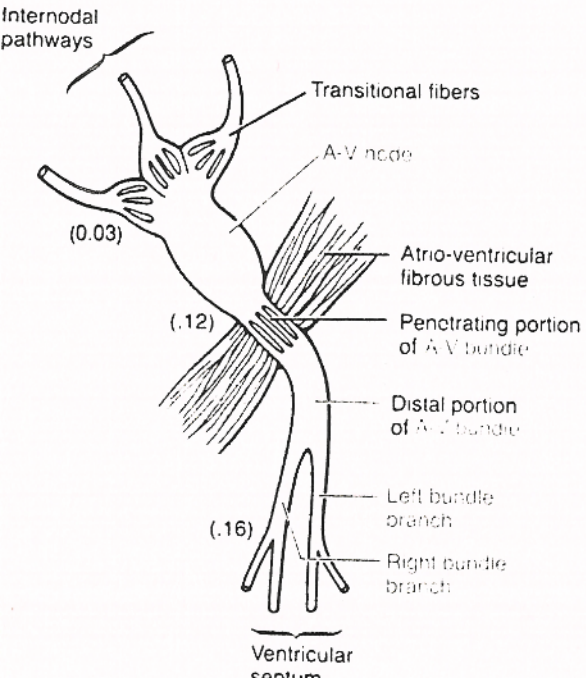
Reflex mechanisms by which lower arterial pressure following blood loss is brought back toward normal. The compensatory mechanisms do not restore arterial pressure completely to normal.



Mechanisms inducing fainting in response to a strong emotional stimulus.

U tube. In effect, the gravitational pressures in the two arms of the U tube cancel each other out, leaving no net pressure to cause flow. The flow through any curved tube depends upon the difference in pressure between the two ends of the tube and not upon the orientation of the tube in space. In the body the heart produces the pressure difference between aorta and right atrium which leads to a blood flow, and changing the position of the blood vessels when changing from a lying to a standing position does not directly alter the relationship between pressure


.07
.04
.09
.06
.22
SA
.03
.07
.19
.00
AV
.16
.03
.05
.21
.07
.18
.19
.17
.17
.21
.18
.20


Internodal pathways
Transitional fibers
A-V node
(0.03)
Atrio-ventricular fibrous tissue
(.12)
Penetrating portion of A-V bundle
Distal portion of A-V bundle
Left bundle branch
(.16)
Right bundle branch
Ventricular septum