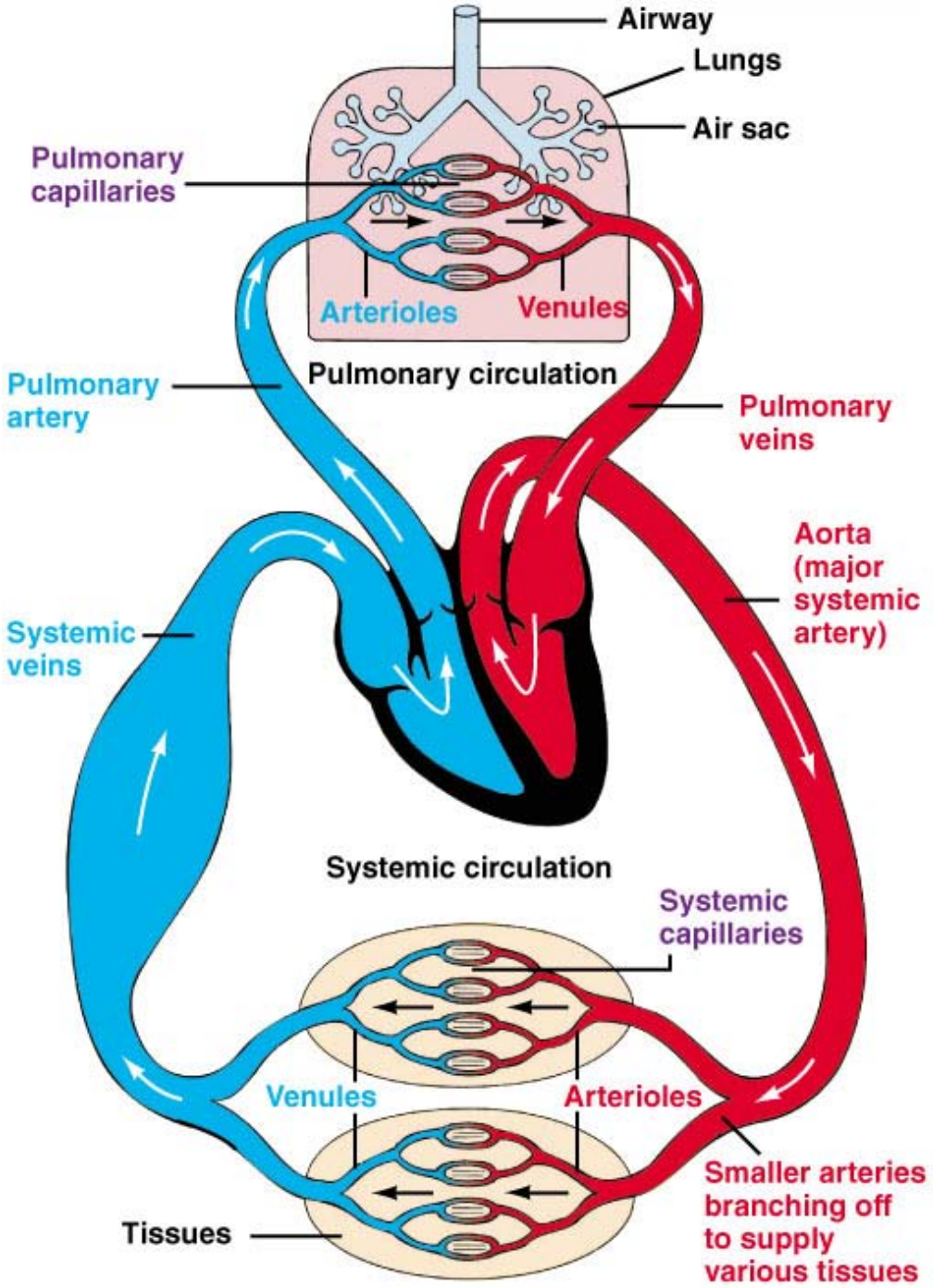
Cardiac Cycle
&
Heart Sounds

A.J. Davidoff

hrt-lng-bld-flo.exe



Sherwood Fig 10-2

Thought Case

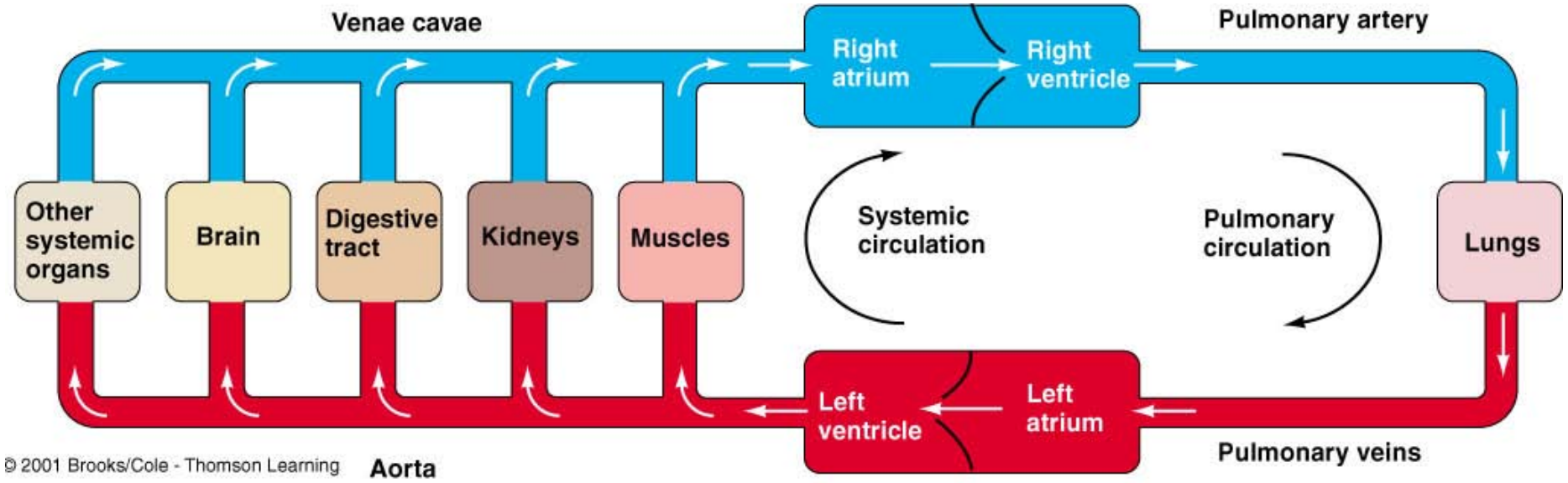
A 69-year old man sees you in the office for follow-up of his chronic congestive heart failure. He has a marked reduction in his ejection fraction following a series of myocardial infarctions. He also has hypertension and type 2 diabetes mellitus. His symptoms include dyspnea on exertion, orthopnea, paroxysmal nocturnal dyspnea, and peripheral edema. He has normal renal function. He is on appropriate treatment of his diabetes, along with an angiotensin-converting enzyme inhibitor and a loop diuretic. You decide to add digoxin to his regimen.

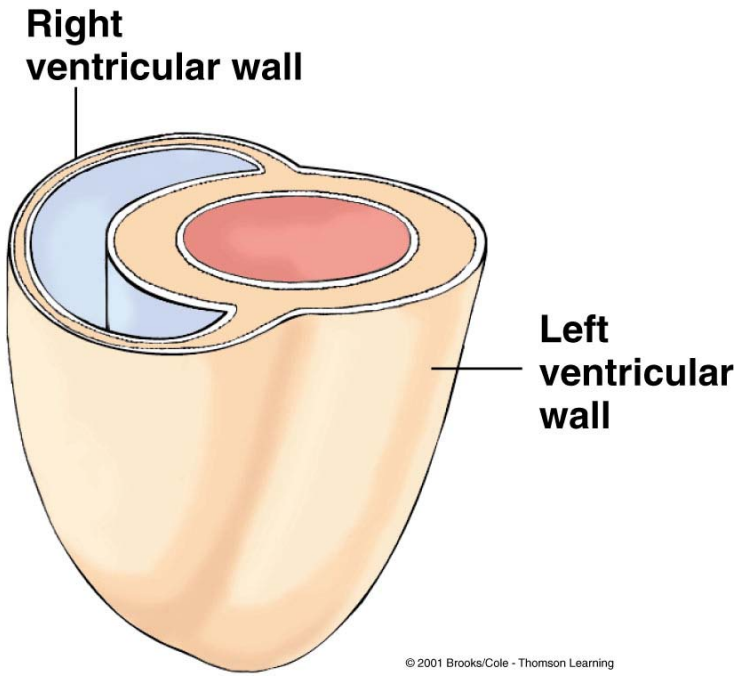
digoxin is a positive inotropic drug

From Toy, Rosenfeld, Loose, Briscoe: Case Files; Pharmacology (Lange) 2005

Goals:

- Direction of blood flow through the heart (valves)
- Cardiac cycle
- Intrinsic and extrinsic control of cardiac output
- Coronary blood flow
- Effects of heart failure on cardiac output





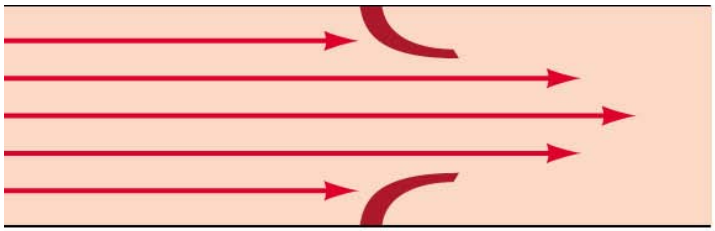
Does cardiac output from RV = LV?

Why is LV > RV in size?

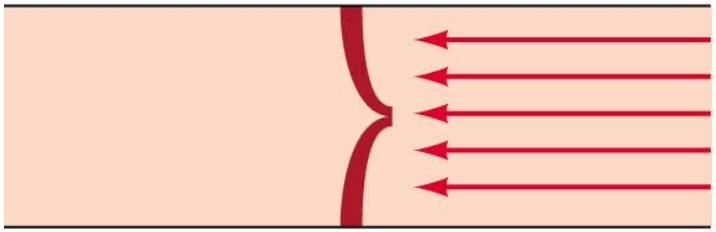
Sherwood Fig 9-3

Blood flow is directional because of valves

$P_1 > P_2$



Valve opened



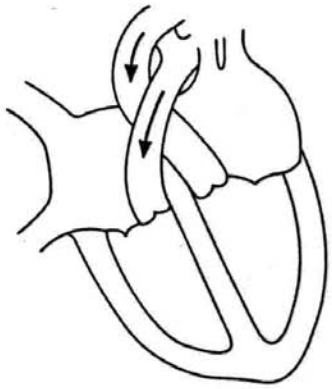
Valve closed; does not open
in opposite direction

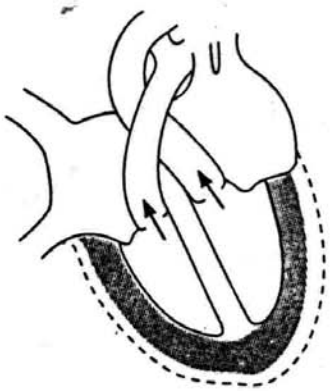
$P_1 < P_2$

HeartValves.MOV

Sherwood Fig 9-4

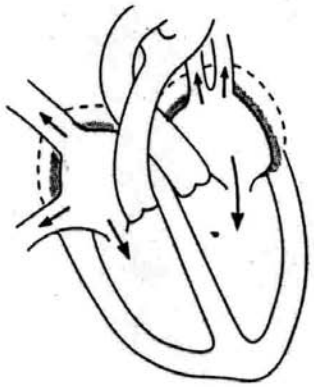
5



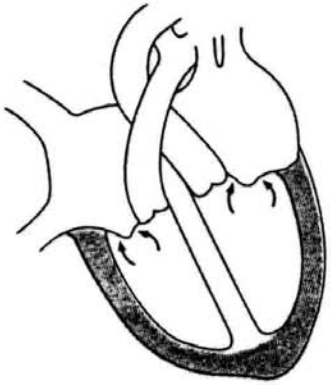


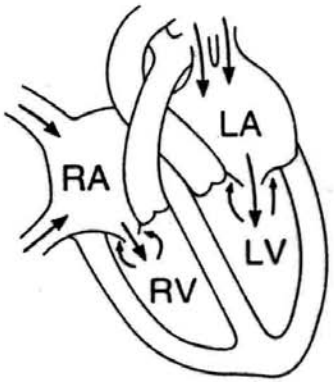
4

2



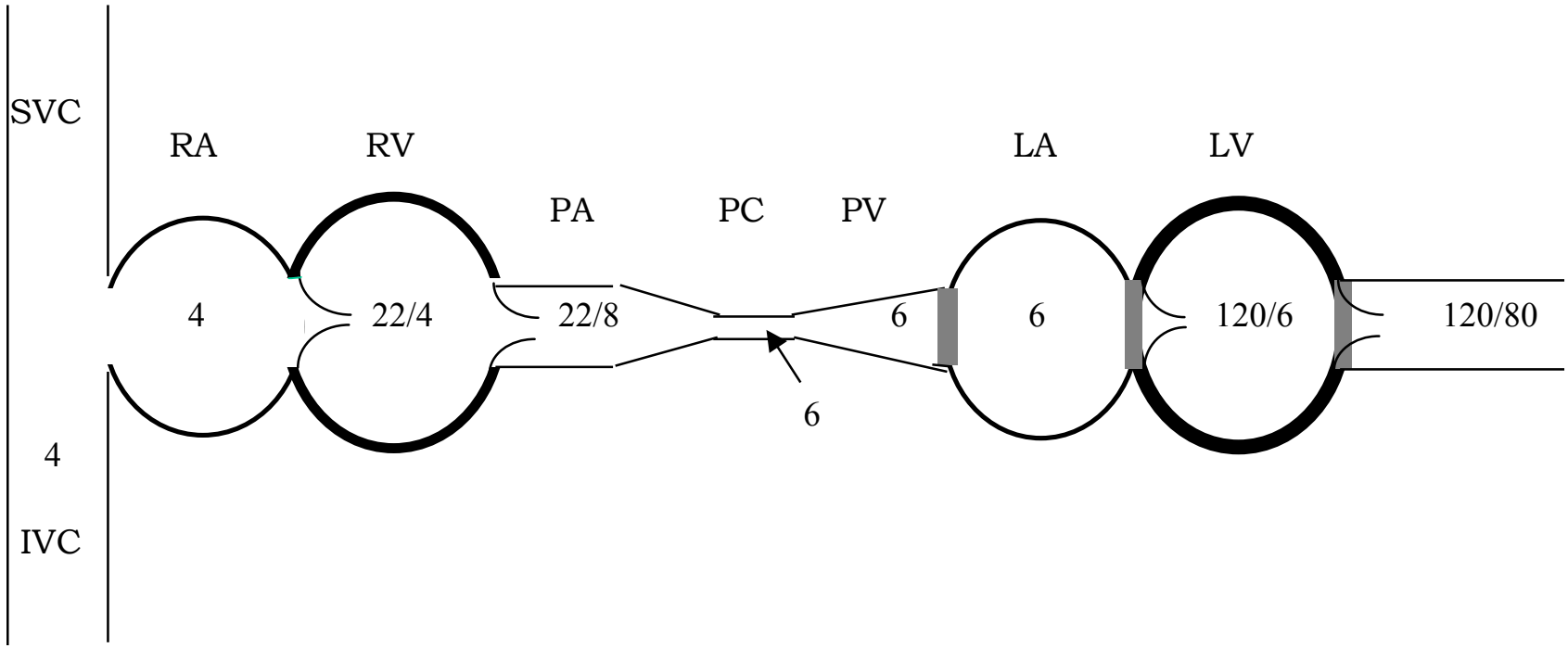
3





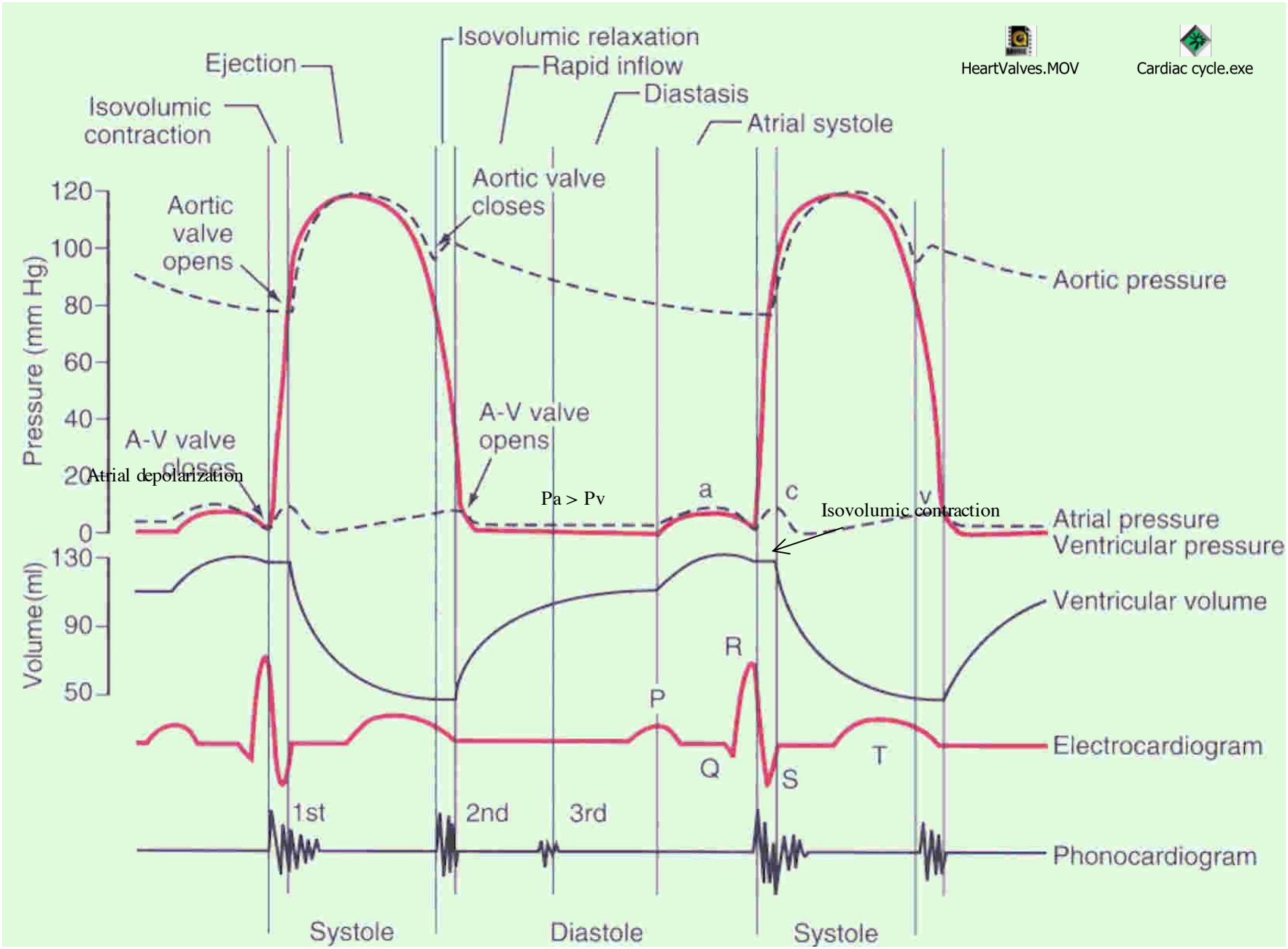
1

Normal Hemodynamics

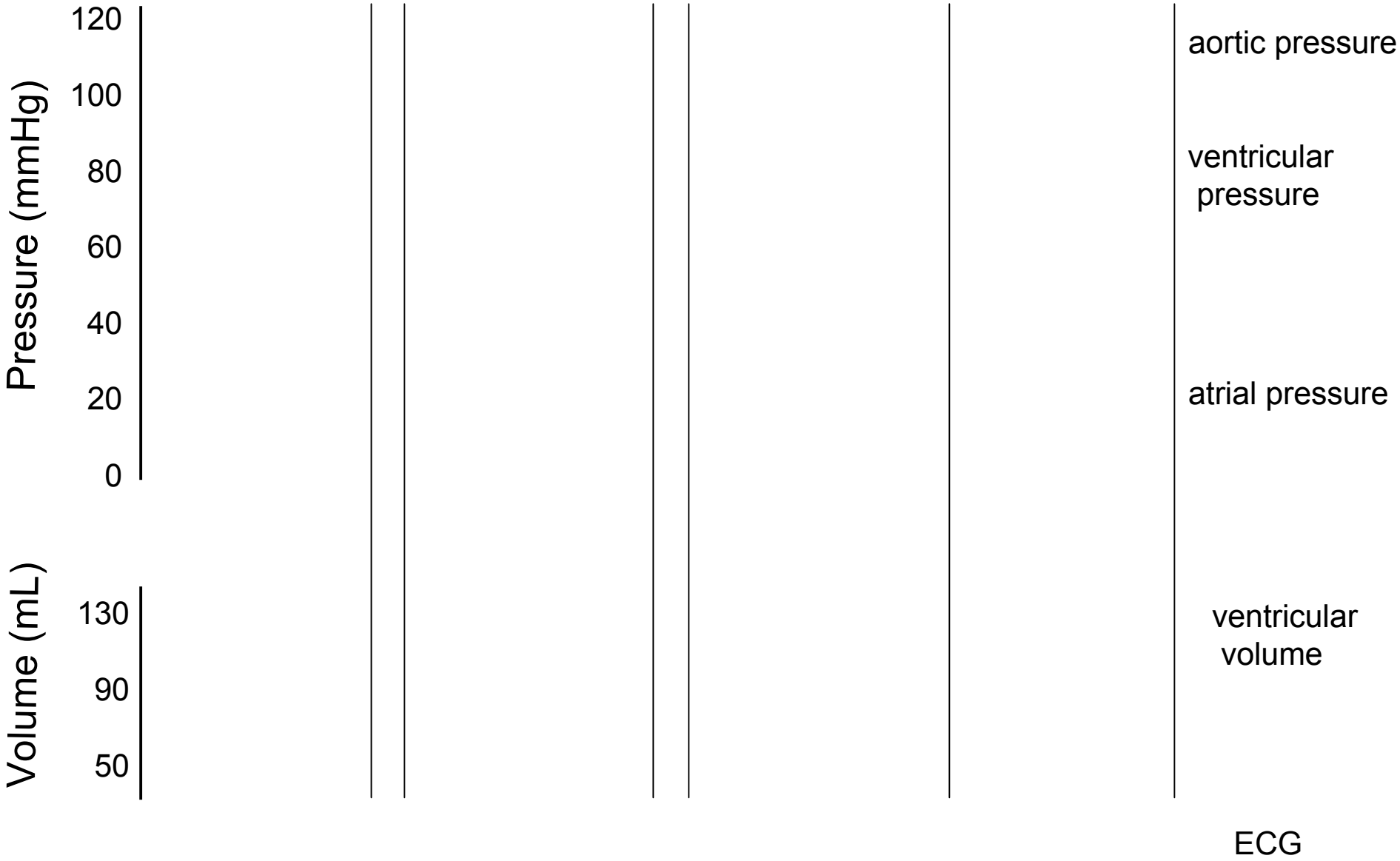


Pressures: mm Hg

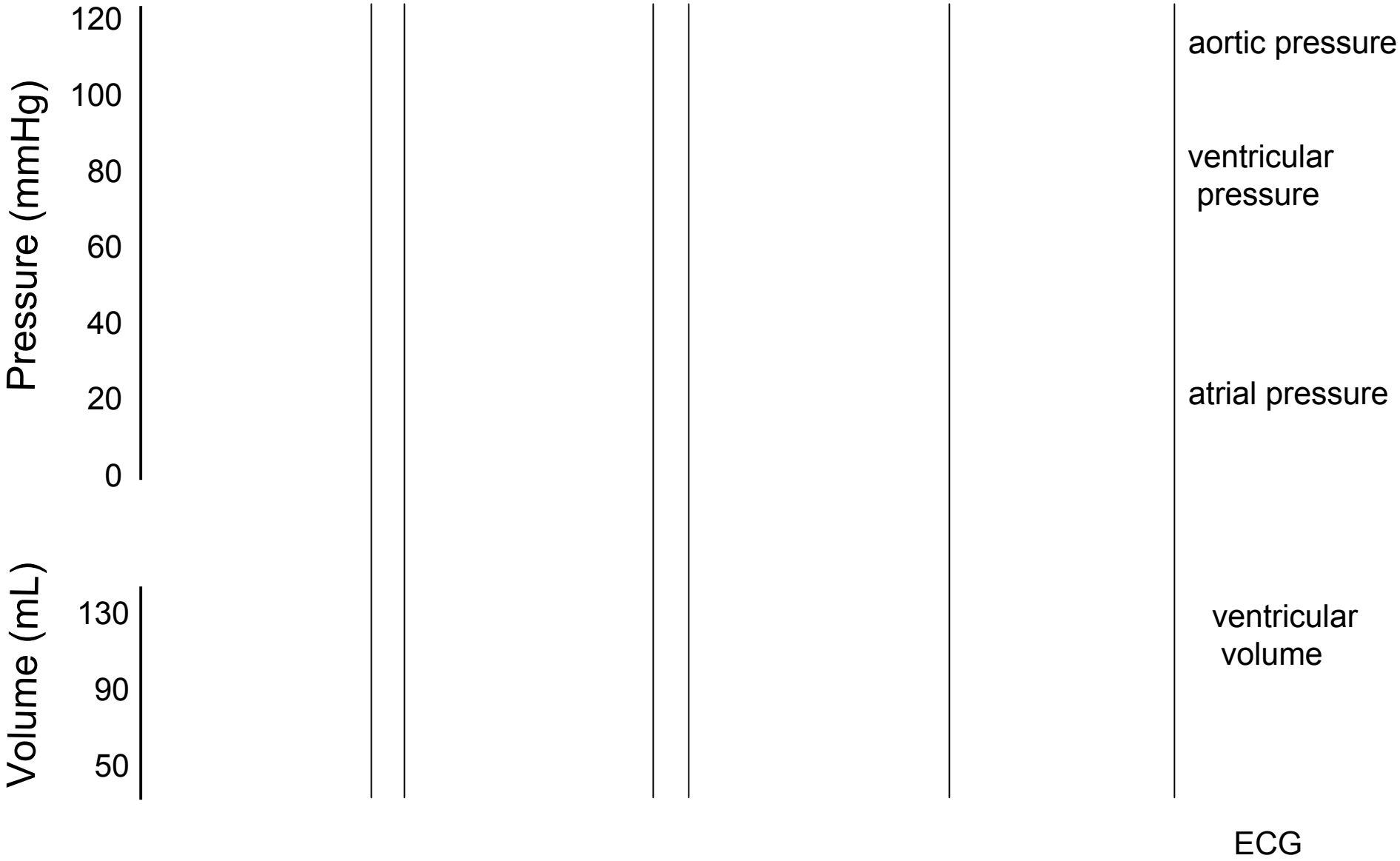
J D Marsh


HeartValves.MOV
Cardiac cycle.exe
Isovolumic relaxation
Ejection
Rapid inflow
Diastasis
Isovolumic contraction
Atrial systole
Aortic valve closes
Aortic valve opens
Aortic pressure
Pressure (mm Hg)
120
100
80
60
40
20
0
A-V valve opens
A-V valve closes
Atrial depolarization
Pa > Pv
a
c
v
Isovolumic contraction
Atrial pressure
Ventricular pressure
Volume (ml)
130
90
50
Ventricular volume
R
P
Q
S
T
Electrocardiogram
1st
2nd
3rd
Phonocardiogram
Systole
Diastole
Systole

G&H Fig 9-5

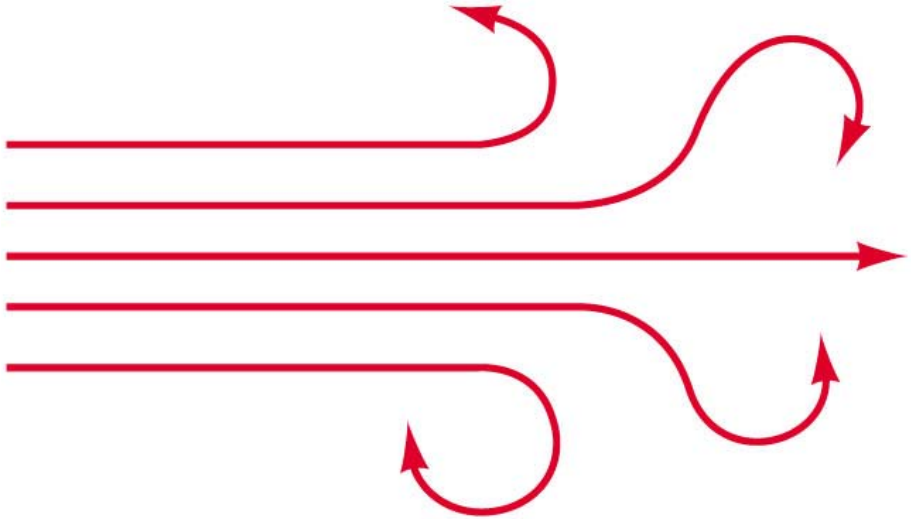


http://library.med.utah.edu/kw/pharm/hyper_heart1.html


Pressure (mmHg)
120
100
80
60
40
20
0
Volume (mL)
130
90
50
aortic pressure
ventricular pressure
atrial pressure
ventricular volume
ECG

Basis of Heart Sounds

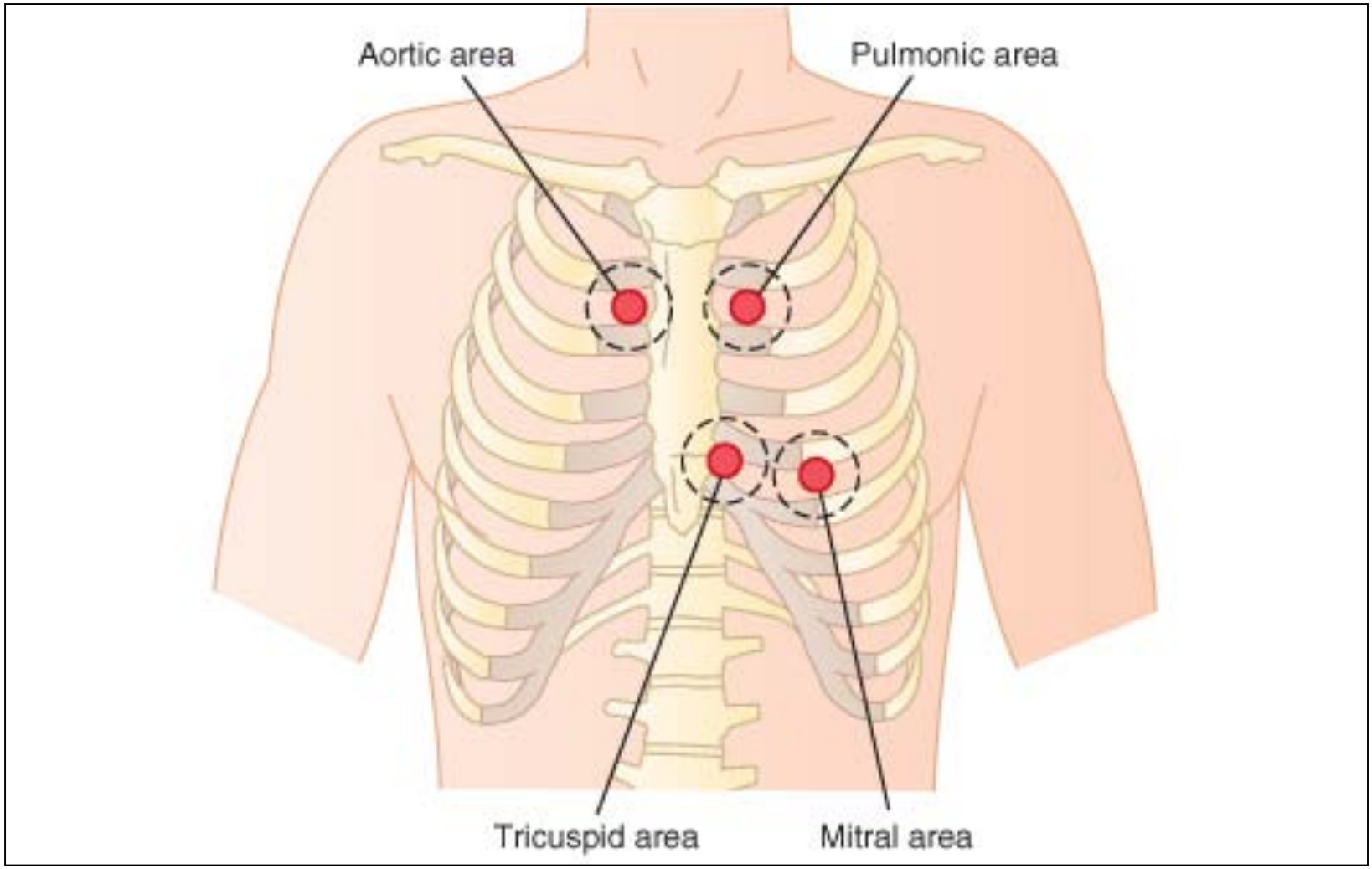
Laminar flow (does not create any sound)



Turbulent flow (can be heard)

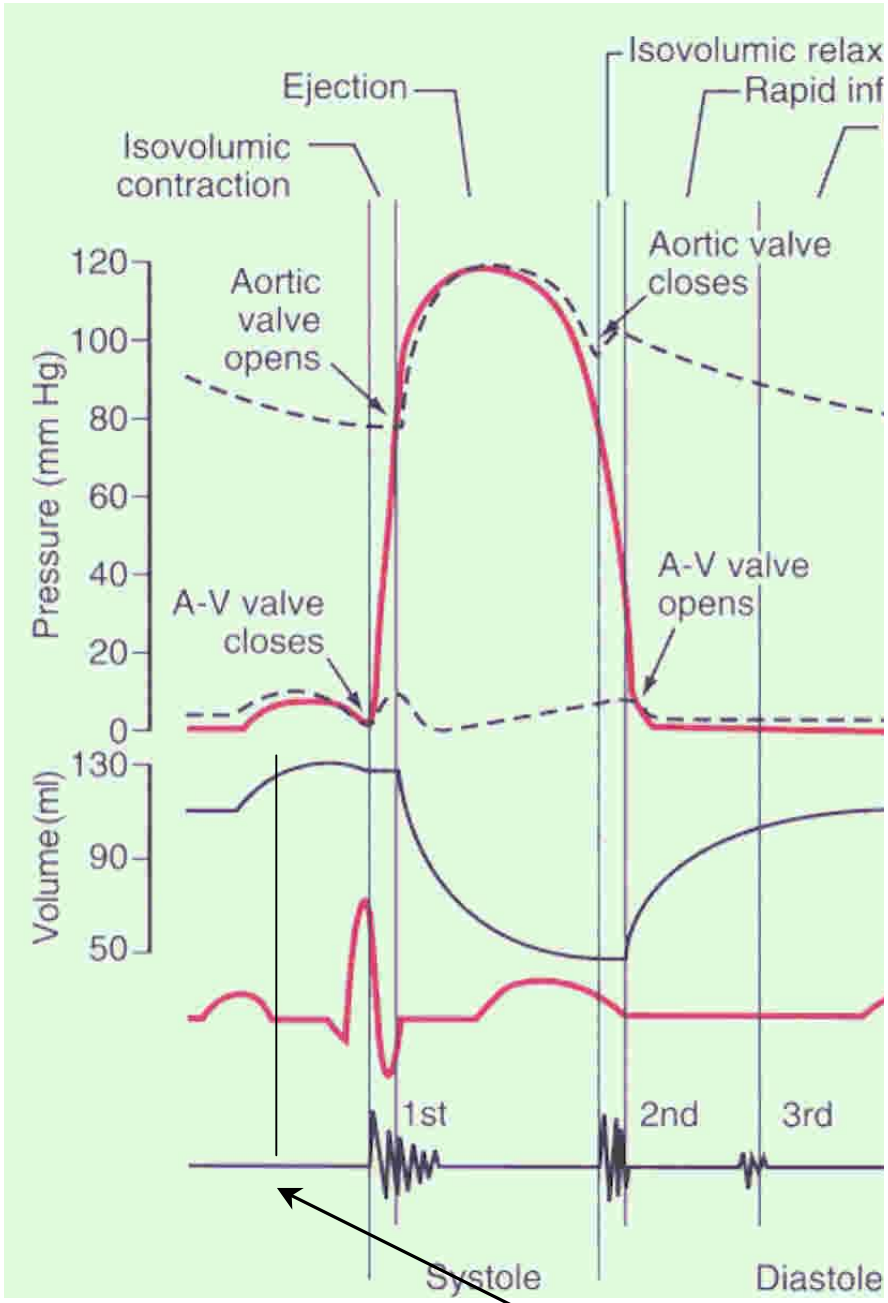
Sherwood Fig 9-23

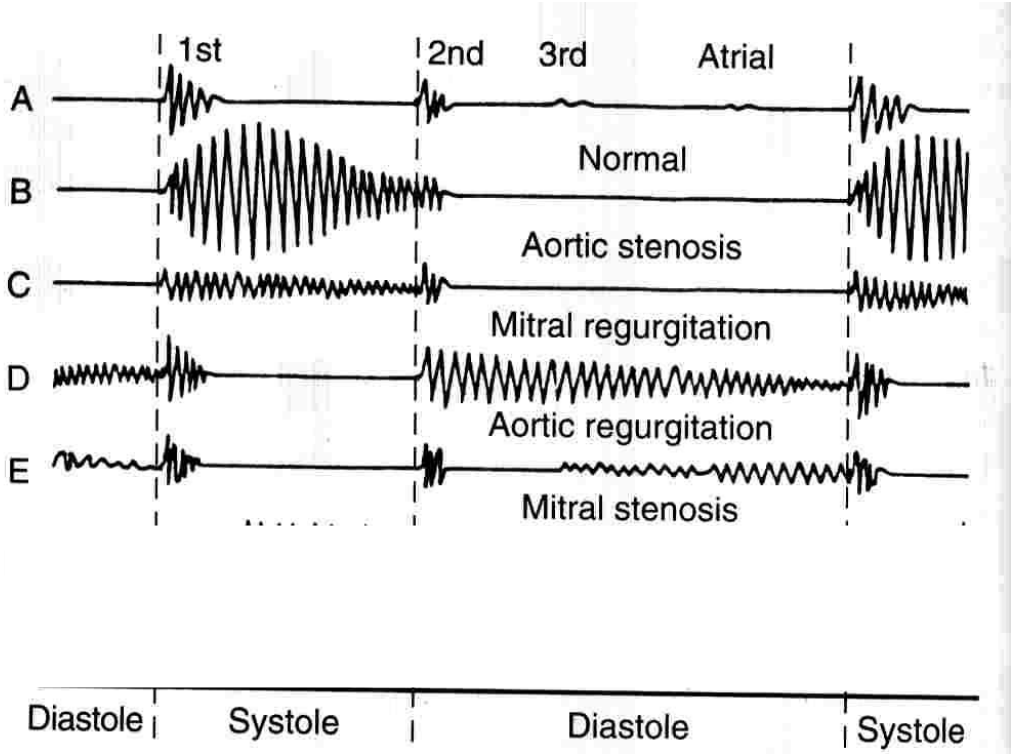
Why are these appropriate areas to hear abnormalities?



G&H Fig 23-2

Cardiac Cycle.exe





G&H Fig 9-5

S4 (atrial kick against a stiff ventricle)

G&H Fig 23-3