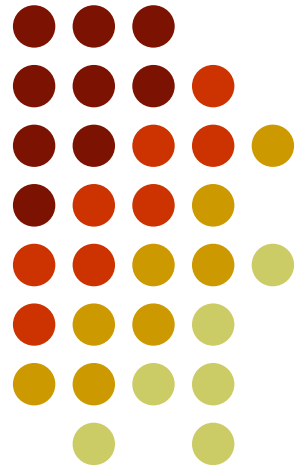
Assessment of Cardiac System



Cardiovascular (CV) System: Anatomy & Physiology

- CV consists of the heart ,a muscular pump & the bld vessels.
- Land mark of the chest \ pericardium:
  - suprasternal notch.
  - angle of Louis
  - Anterior Axillary Line (A A L).
  -Midaxillary Line (M A L).
  - Posterior Axillary Line (P A L)
  - sternal Border (SB).
  - Midclavicular Line (MCL)
  - Intercostals spaces (I CS) 2- 5 th ICS

- **The Base** – the top of the heart (atria)
- **The Apex** – the bottom (LV)
- **The Pericardium** – the surface of the chest wall overlaying the heart (2nd to 5 th ICS from RSB to LMCL)
- What parts are where?

- **right ventricle** – anterior , behind & long LSB .

- **left ventricle** – behind & to the left of RV , forms left border & creates apical impulse.

- **right atrium** – lies above & slightly to right of RV, forms right border of the heart , not usually identifiable .

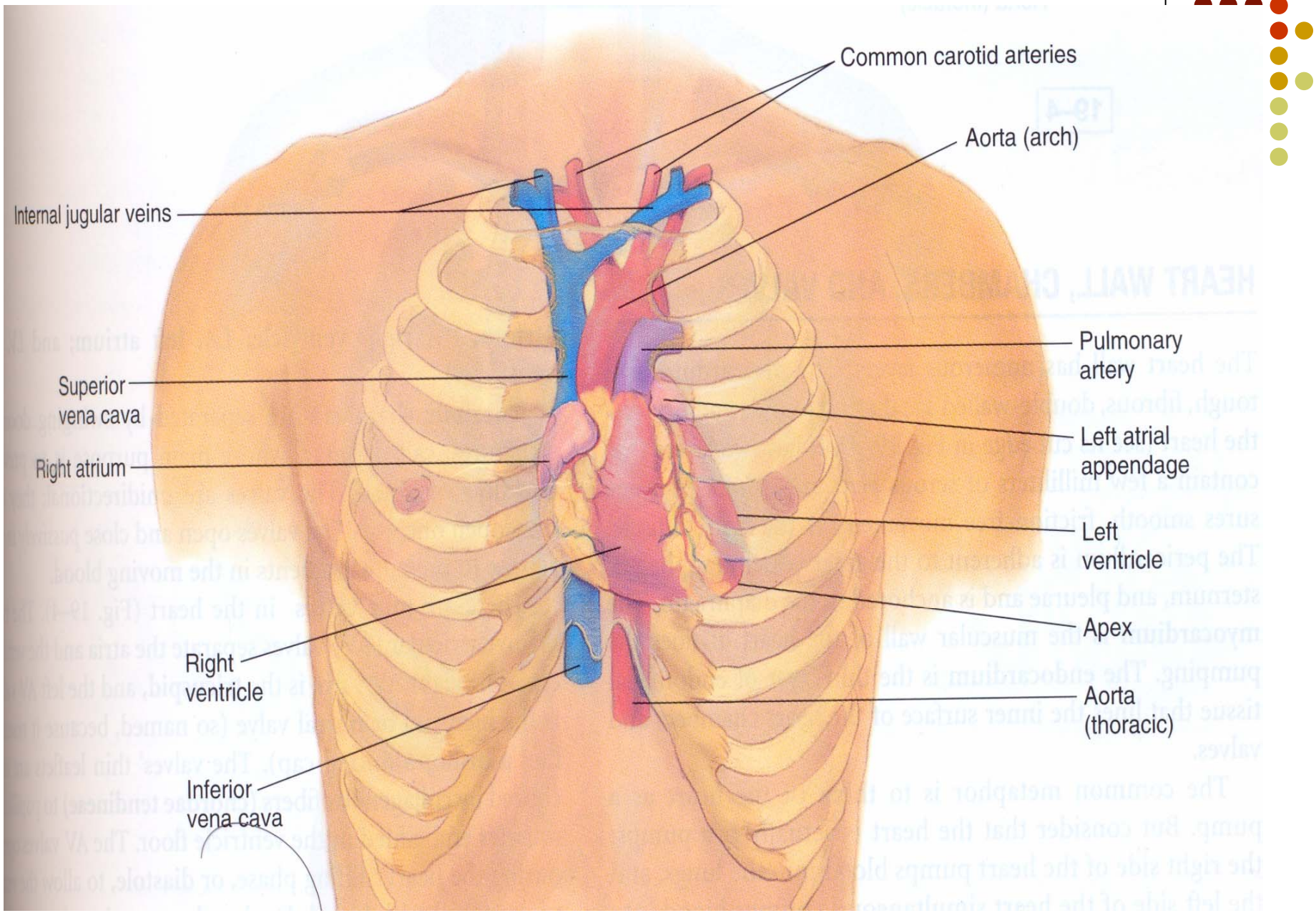
- **left atrium** – above LV, mostly posterior , can't be examined directly.

- **Aorta** – up from LV to sternal angle ,then back, down.

- **Pulmonary artery** – up from RV, 3rd ICS bifurcates into R & L branches.

- **Vena Cave** – empty into RA.

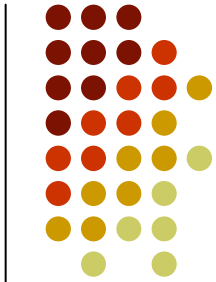
** WHAT ELSE IS IN THERE?


Common carotid arteries
Aorta (arch)
Internal jugular veins
Pulmonary artery
Superior vena cava
Left atrial appendage
Right atrium
Left ventricle
Apex
Right ventricle
Aorta (thoracic)
Inferior vena cava

Valvular Control of Blood Flow

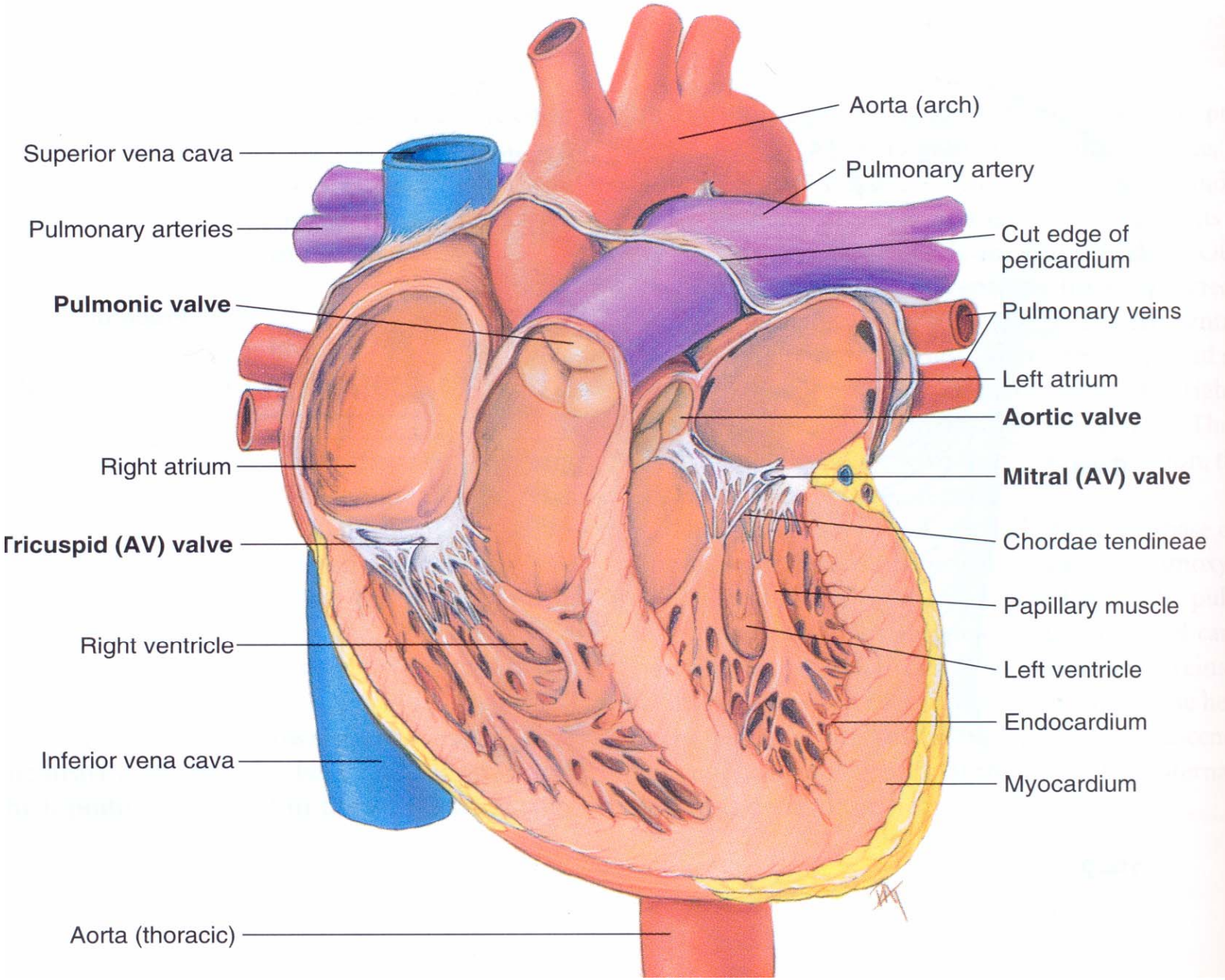
- **Systole –** period of ventricular contraction. the mitral & tricuspid valves close (**S1**) preventing back flow & aortic & pulmonic valves open permitting forward flow. Bld is ejected into aorta by LV & pulmonary artery by RV.
- **Diastole** – period of ventricular relaxation. The aortic & pulmonic valves close (**S2**) preventing backflow, & mitral & tricuspid valves open permitting forward flow. The atria contract forcing bld into the ventricles.

Chambers, Valves & Circulation



- **Atrioventricular Valves** – between atria & ventricles - tricuspid – between RA & RV
  - mitral – between LA & LV
- **Semi lunar Valves** – between the ventricle & great arteries
  - aortic – between LV & aorta
  - pulmonic – between RV & pulmonary artery.

* closure of these valves creates the normal heart sounds….. Valve opening is normally silent.


Aorta (arch)
Superior vena cava
Pulmonary artery
Pulmonary arteries
Cut edge of pericardium
Pulmonic valve
Pulmonary veins
Left atrium
Aortic valve
Right atrium
Mitral (AV) valve
Tricuspid (AV) valve
Chordae tendineae
Papillary muscle
Right ventricle
Left ventricle
Endocardium
Inferior vena cava
Myocardium
Aorta (thoracic)

Events Of the Cardiac Cycle

- **Systole :** ventricle contract ….
  - ventricular pressure > a trial pressure
  - mitral & tricuspid valves close = S1 (“ lubb”)
  - ventricular pressure continues to rise
  - ventricular pressure > a trial pressure
  - aortic & pulmonic valves open
  - bld flow forward through aorta to systemic circulation & pulmonary artery to the lungs.
  - ventricle become almost empty > ventricular drops.
  - ventricular pressure drops below arterial pressure.

Events Of the Cardiac Cycle (cont)

- **Diastole:** ventricular pressure drops below arterial pressure.

- aortic & pulmonic valves close = S2 (“dubb”).

-arterial pressure > ventricular pressure.

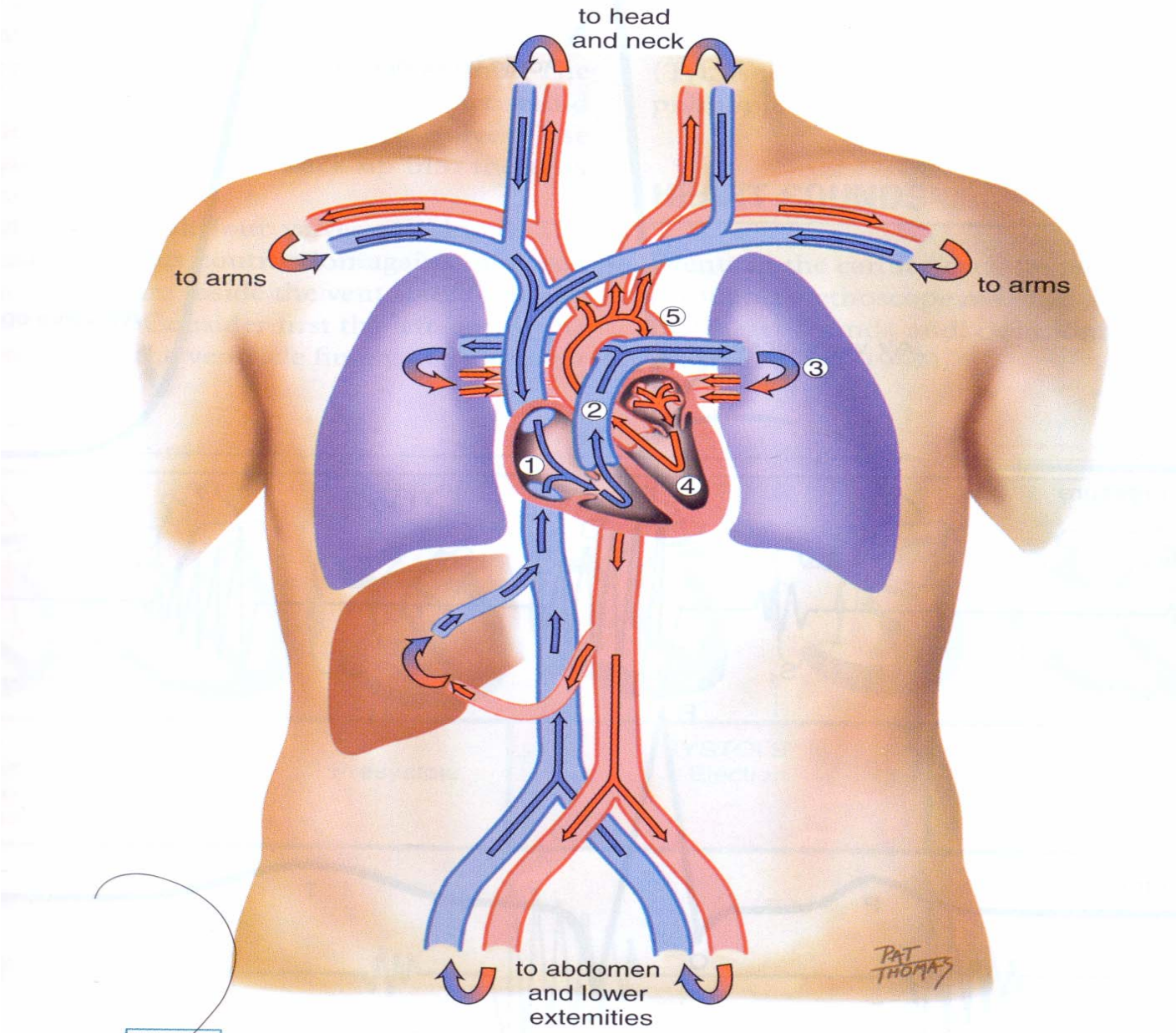
- mitral & tricuspid valves open

- bld flow from atria to ventricles.

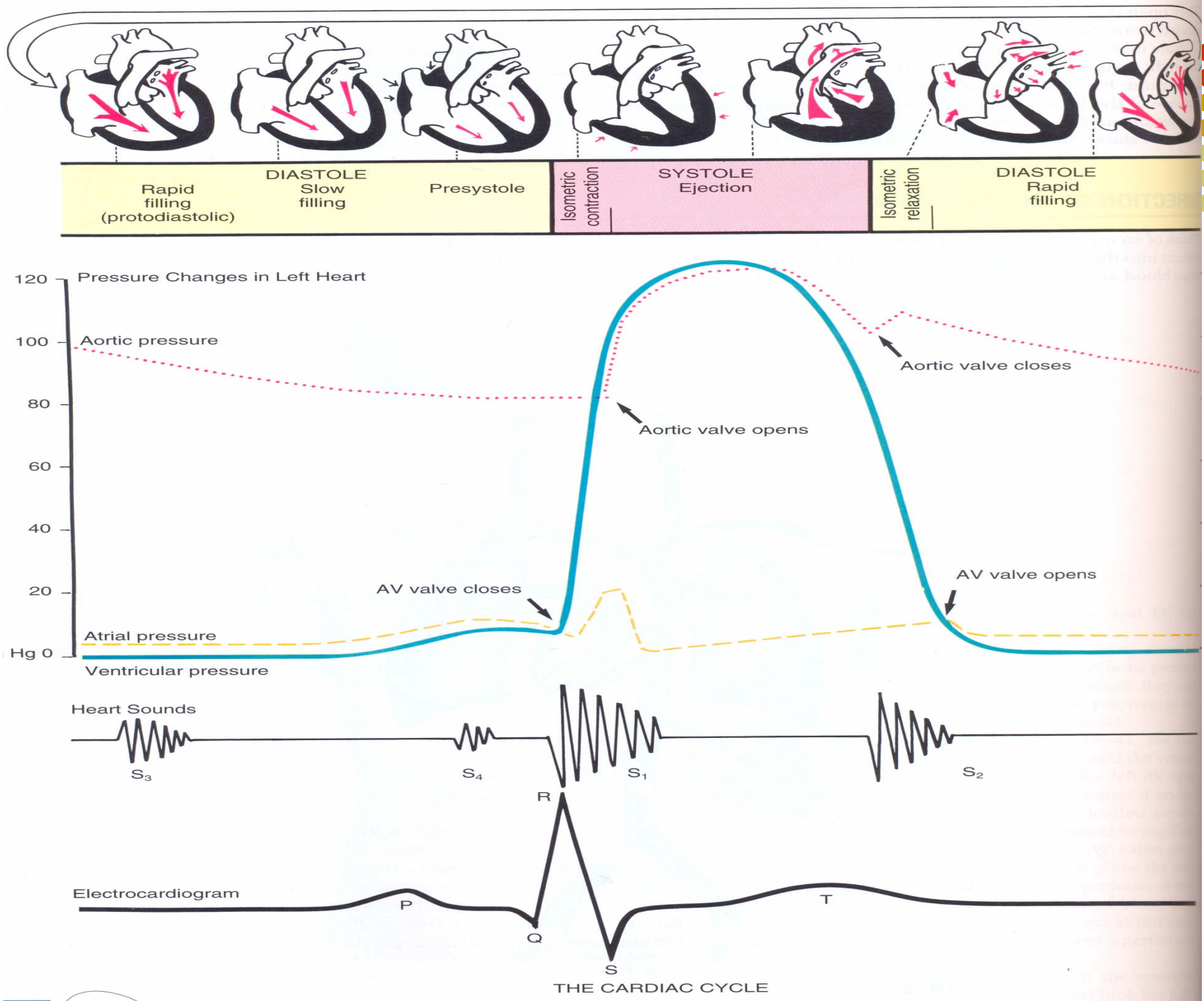
- atria contract to eject remaining bld & increase ventricular end – diastolic pressure.

- ventricular pressure > arterial pressure

=> mitral & tricuspid valves close (S1) beginning another systole….


to head
and neck
to arms
to arms
5
3
2
1
4
to abdomen
and lower
extemities
PAT
THOMAS

19–5



THE CARDIAC CYCLE

Conduction System in the Heart

- SA node (sinus node)
  - located in the RA.
  -acts as the cardiac pacemaker
  - automatically discharge 60-100 times\ min.

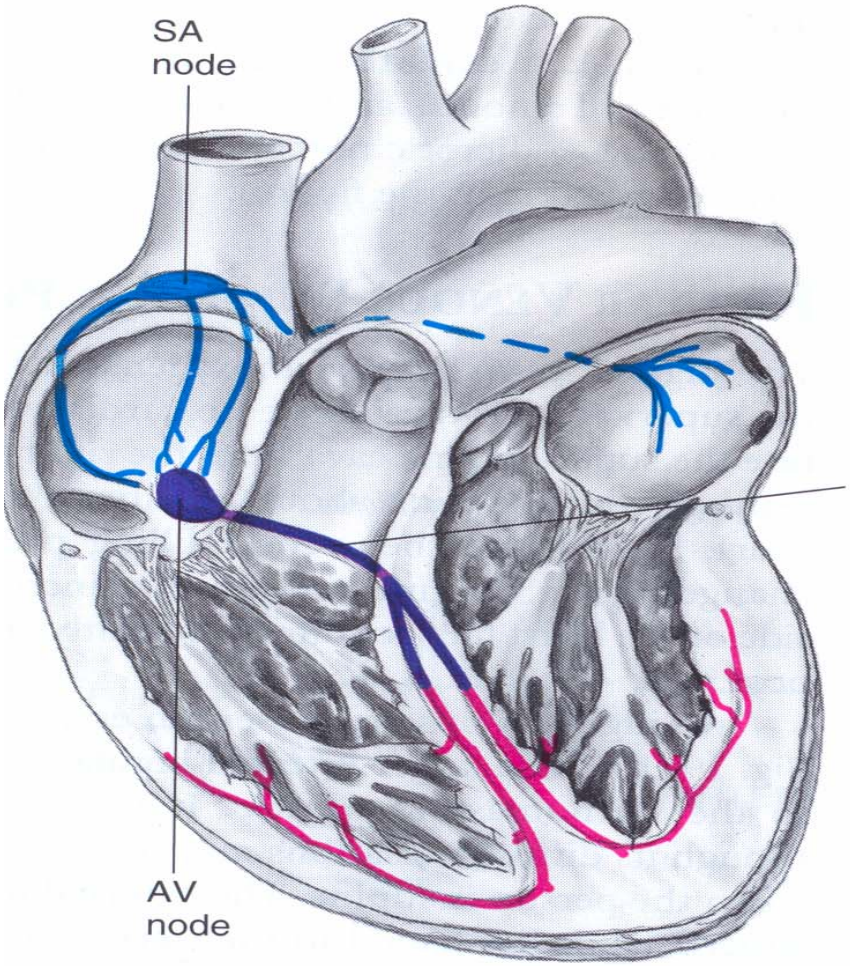
. AV node (atrioventricular)

- located at the atrial septum
- delay the impulse fired by the SA node before the impulse passes to the nodule to the bundle of His.

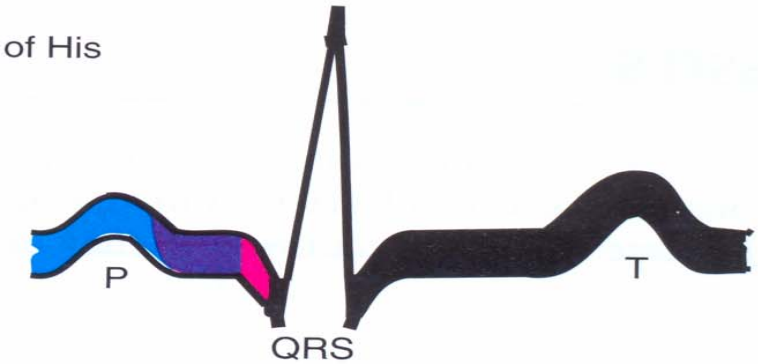
. Bundle of His – starts in intraventricular septum, then divides into Rt & Lt bundle branches which carry the electrical impulses to the….

. Purkinje fibers – in the ventricular myocardium where ventricular contraction is stimulated

- **p-wave** : atrial depolarization
- **QRS complex** : ventricular depolarization
- **T wave** : ventricular repolarization



Conduction system



Electrocardiograph (ECG) wave

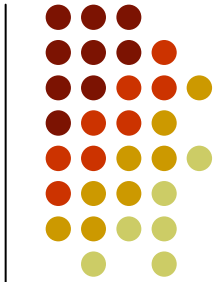
19–8

Normal Heart Sounds

- S1 (lub):
  - caused by closure of atrioventricular valves (AV, mitral & tricuspid)
  - the start of systole
  - louder than S2 at the apex
  - heard with diaphragm
  - coincide with the R wave of the QRS complex of the ECG.

- S2(Dup)
  - closure of semi lunar valves (aortic & pulmonic)
  - heard with diaphragm
  - loudest at the base
  - normal splitting of S2 may occur with inspiration (aortic & pulmonic valves closers separately)
  - heard over pulmonic area (2nd left ICS)

The Splitting of Heart Sounds



- The events are occurring on both sides of the heart
- Right – sided events usually occur slightly later than left – sided events
- Therefore , may hear 2 sounds for:

- S1 (“spilt S1”), the mitral component > tricuspid
- S2 (“spilt S2”), the aortic component> pulmonic

- Spilt sounds may be normal (physiologic) or abnormal (pathologic).

Extra Heart Sounds
S3 S4 occur during diastolic phase

- **S3(ventricular gallop):**

- a ventricular filling sound
- in early diastolic after S2.
- best heard at apex or left lower sternal border.
- best heard with diaphragm .

- Indicate decrease ventricular compliance
- Normal in children & young adult up to 40 ys, then considered abnormal.
- Occur in pts with HF, aortic ,mitral or tricuspid regurgitation

- S4(atrial Gallop):

- a ventricular filling sound
- in late diastolic immediately before S1
- best heard at the apex in the left lateral position
- best heard with the bell
- soft low pitch
- indicates decrease compliance of ventricle
- could normal in adults > 40 ys
- more commonly associated with resistance to ventricular filling.

Murmurs

- Murmurs are vibratory sounds caused by turbulent bld flow.
- 4 causes of murmurs:

- **stenosis**- forward bld flow through a constricted area.
- **regurgitation** – backward bld through an incompetent valve
- **structural defect** – bld flow through abnormal passage
- **physiologic** – increased bld flow (high output) through a normal valve.

Subjective Data

1- chest pain:

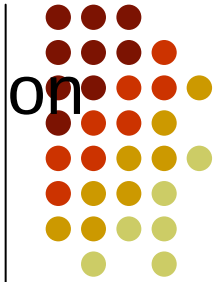
- onset: when did it start? had this type of pain before?
- Location: how would u describe it?
- Pain brought on by :any activity – what type ,rest, after eating?
- Any associated symptoms: sweating , SOB, nausea, vomiting,?
- Pain made worse by moving the arms or neck?
- Pain relived by rest or nitroglycerine? How many tablets?

- Angina occurs when heart's vascular supply cannot keep up with metabolic demand.
- Try to differentiate pain of cardiac versus non cardiac origin.

2- Dyspnea: any SOB ?

- What types of activity & how much brings on shortness of breath?
- Onset :does the SOB come on unexpected?
- Duration :constant or does it come & go?
- Seem to be affected by positions ?
- A waken u from sleep at night?

. Does the SOB interfere with activities of daily living?



- Dyspnea: Dyspnea on exertion (DOE) – quantify exactly.
- Paroxysmal nocturnal dyspnea (PND) occurs with heart failure . Classically , the pt awaken after 2hr of sleep

3- Orthopnea :how many pillows do u use when sleeping ?

4- Cough: do u have a cough?

- Duration: how long have u had it?
- Frequency: is it related to time of day?
- Type: dry, hacking, or congested?
- Associated with : activity , position , anxiety?
- Relieved by rest or medication?

- Orthopnea is the need to assume a more upright position to breath . Note the exact number of pillows used.
- Septum production. Hemoptysis is often a pulmonary disorder but also occur with mitral stenosis.

5- fatigue : do u seem to tire easily ?

- Onset: when did fatigue start? sudden or gradual?
- Fatigue related to time of day: all day or morning, evening?

6- Cyanosis or pallor: ever noted ur facial skin turn blue or ashen?

- Fatigue due to decreased CO is worse in the evening ,where as fatigue from anxiety occurs all day
- Cyanosis or pallor occurs with myocardium infraction or low cardiac output states due to decreased tissue perfusion

7- Edema: any swelling of ur feet& legs?

. Onset, any recent changes? what times of day does swelling occur? How much swelling would u say there is? does swelling go away with rest, elevation ,after night? Any associated symptoms, such as SOB ?when it’s occur?

- Edema is dependent when due to heart failure.
- Cardiac edema is worse at evening & better in morning after elevating legs all night.

- **8- nocturia** : do u waken at night with an urgent need to urinate? any recent changes?
- **9- past cardiac history:** any past hx of HTN ,elevated cholesterol, heart murmurs, congenital heart disease , anemia? when this happen? Last ECG?

- Nocturia recumbency at night promotes fluid reabsorption & excretion, this occurs with heart failure.

- **10- family cardiac hx:** HTN, obesity, CAD, sudden death?
- **11- personal habits (cardiac risk factors):** - nutrition :wt, cholesterol , the amount of calories , any additives salt?

  - smoking: do u smoke?

  - alcohol:

  - exercise : what's ur usual amount of exercise ?

  - drugs: which types of medications?

OBJECTIVE DATA

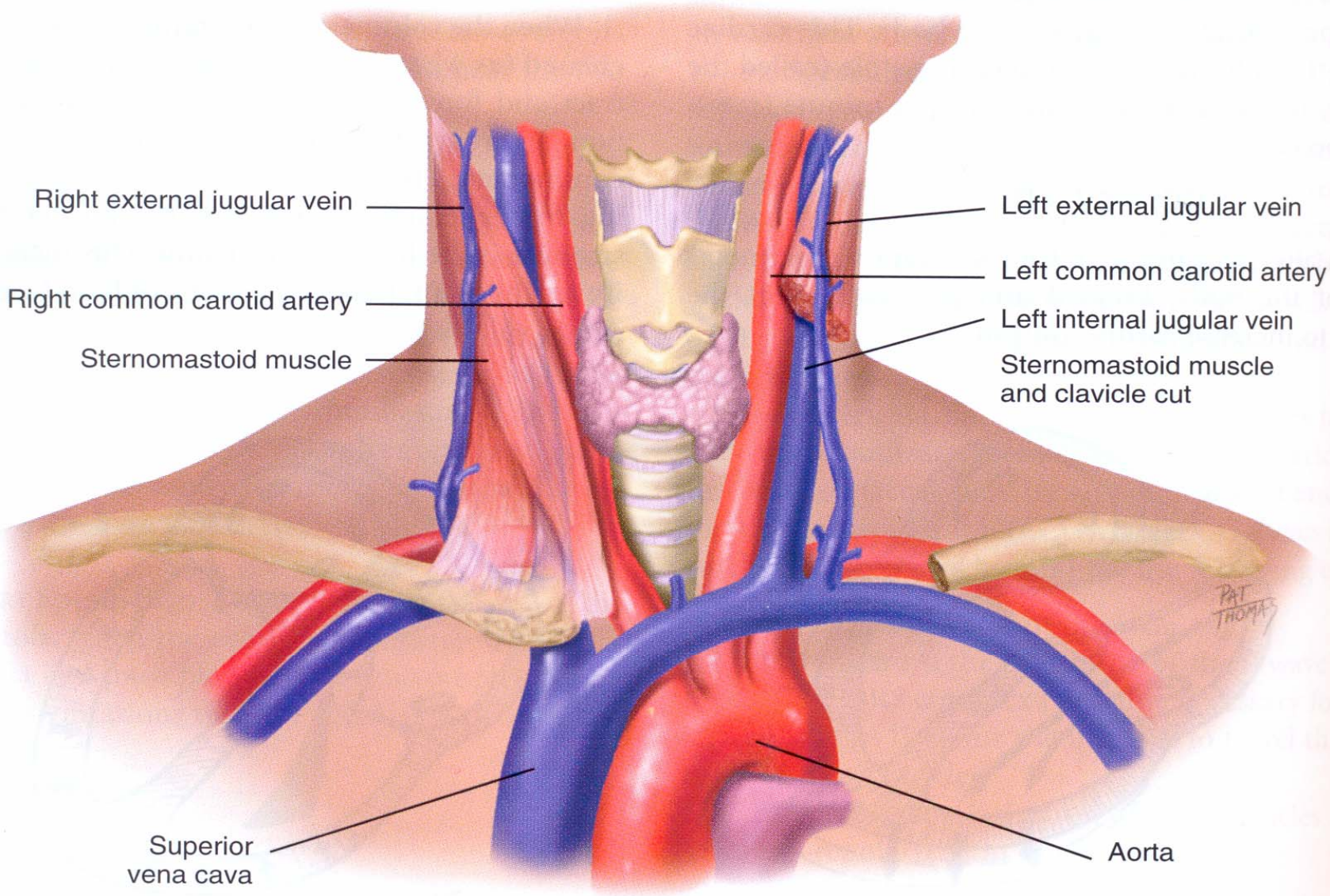
- **Preparation:**
  - the person can be sitting , supine,& stand.
  - room must be warm.
  - privacy.

- **Equipments:**
  - marking pen.
  - small centimeter ruler.
  - stethoscope.
  - alcohol swap.

The neck vessels

- **Palpate the carotid artery:** located central to the heart (give important information on cardiac function) . Normally contour smooth with rapid upstroke & slower down stroke , normal strength +2

- Diminished pulse feels small & weak (decreased in stroke volume)
- Increased pulse full & strong (hyperkinetic states)
-



NECK VESSELS

- **<u>Ausculteate the carotid artery:</u>** for who show symptoms or signs of cardiovascular disease , Ausculteate for the presence of a bruit , this is a blowing , swishing sound indicating bld flow turbulence , normally is not present

- A bruit indicating turbulence due to a local vascular cause , such as atherosclerotic narrowing.

- **Inspect the jugular venous pulse**: u can assess the central venous pressure (CVP) to judge the heart's efficiency as a pump .
- - external jugular vein: overlaying stern mastoid muscles
- - internal jugular vein: in area of the suprasternal notch or around the clavicle.

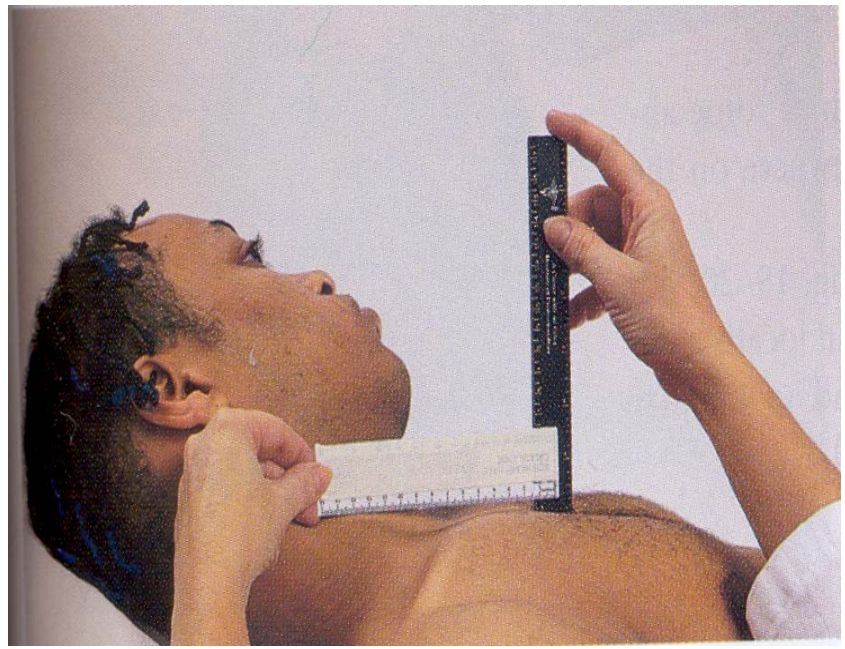
- Unilateral distention of external jugular veins is due to local cause (aneurysm)
- Full distended external jugular veins above 45 degree increased in CVP as with heart faliure.

TABLE 19–1 Characteristics of Jugular Versus Carotid Pulsations

	Internal Jugular Pulse	Carotid Pulse
1. **Location**	Lower, more lateral, under or behind the sternomastoid muscle	Higher and medial to this muscle
2. **Quality**	Undulant and diffuse, two visible waves per cycle	Brisk and localized, one wave per cycle
3. **Respiration**	Varies with respiration; its level descends during inspiration when intrathoracic pressure is decreased	Does not vary
4. **Palpable**	No	Yes
5. **Pressure**	Light pressure at the base of the neck easily obliterates	No change
6. **Position of person**	Level of pulse drops and disappears as the person is brought to a sitting position	Unaffected

- **Estimate the jugular venous pressure:** u can read the CVP at the highest level of pulsation ,use angel of Louis (sternal angle). Normal jugular venous pulsation is 2cm or less than above the sternal angle when elevated 30 degree.

- Elevated pressure is a level of pulsation is more than 3cm above the sternal angle while at 45 degree.



The pericardium

- **Inspect the anterior chest:** u may see apical pulse at 4th or 5th ICS .
- **Palpate the Apical impulse:** (point of maximal impulse) note for :

- location: 4th or 5th ICS shld occupy only in one interspace
- size: normally 1cm x 2cm
- amplitude: normally a short , gentle tap.
- duration: short

- Cardiac enlargement :

- left ventricular dilatation displace impulse down & to left & increase size more than one space.

.increased force & duration but no change in location occurs with left ventricular hypertrophy & no dilatation.

19–20 The apical impulse.

Palpate a cross the pericardium

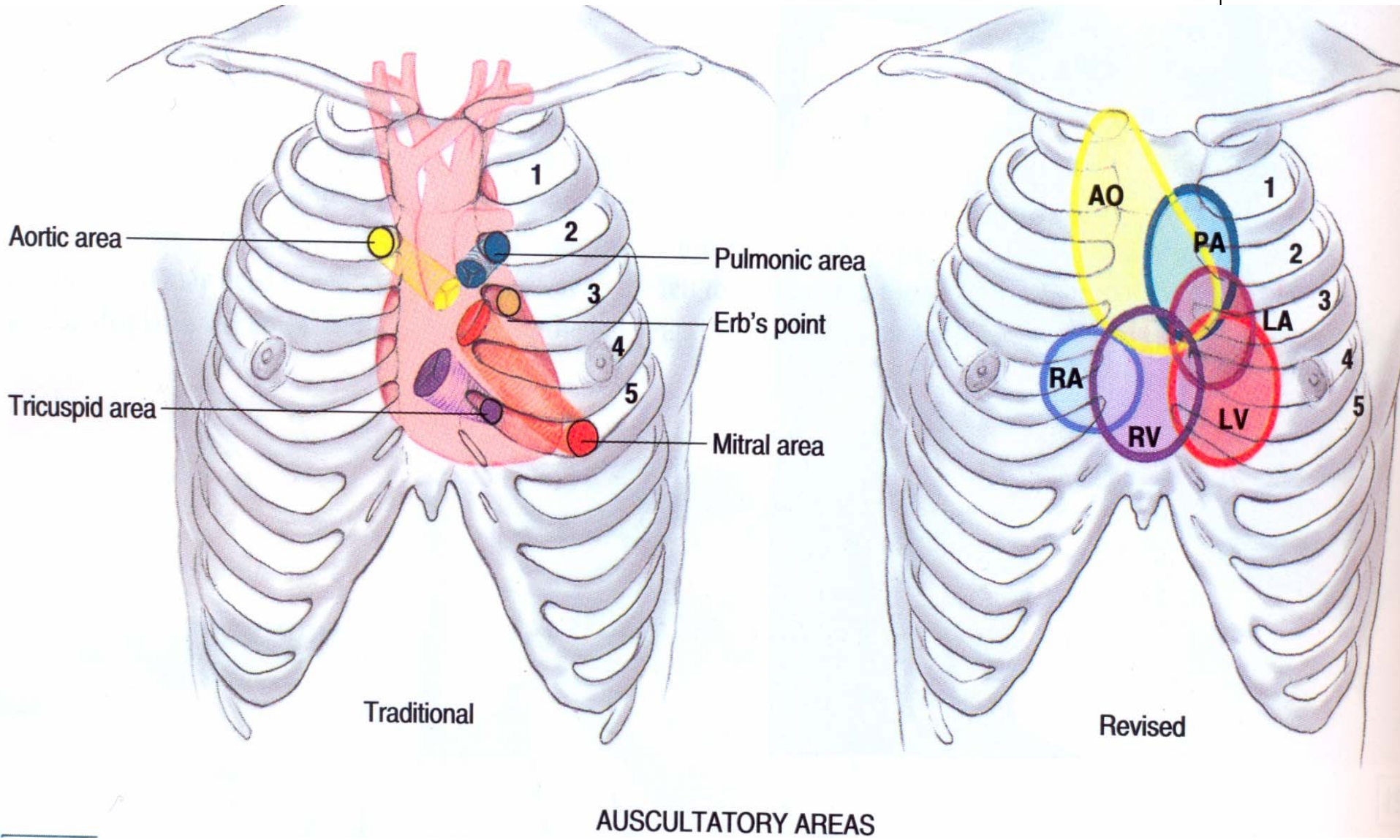
- Using palmar aspect of ur finger gently palpate the apex , the sternal border , the base searching for any other pulsation

- A thrill is a palpable vibration. It feels like throat of a purring cat.
-

- **<u>Percussion:</u>** normally the left border of cardiac dullness is that midclavicular line in 5th & slopes in toward the sternum as u progress upward ,so that by the 2nd ICS the border of dullness coincide with the left sternal border.

- Cardiac enlargement is due to increased ventricular volume or wall thickness.

- **Auscultation :**



AUSCULTATORY AREAS

- Use the following routine:

1- note the rate & rhythm:

rate normally 60-100 b\ min .rhythm regular ,varies with person breathing ,increasing at the peak of inspiration & slowing with expiration.

* if u notice any irregularity ,check for pulse deficit by auscultating the apical beat while palpating the radial pulse .when different , subtract the radial rate from the apical pulse & record reminder as the pulse deficit.

- A pulse deficit signals a weak contraction of the ventricles , occurs with a trial fibrillations ,heart faliure.

2- identify S1 & S2: S1 is the start of systole & serves as reference point for the timing for all other cardiac sounds :

- S1 is louder than S2 at the apex , S2 louder than S1 at the base.
- S1 coincides with carotid artery pulse

3- listen to S1 & S2:listen if heart sound normal , diminished or split

4- focus on systole ,then on diastole ,& listen for any extra sound .listen for murmur is a blowing ,swooshing sound that occurs with turbulent bld flow in heart or great vessels. If u hear any murmur describe as:

- timing: early ,mid, or late systole or diastole

- A systolic murmurs occurs with normal heart or with heart disease . A diastolic murmurs always indicating heart disease.
-

- loudness :six grades

. Grade i: barely audible

. Grade ii : clearly audible

. Grade iii: moderately loud .

. Grade iv: loud associated with a thrill palpable on the chest wall

. Grade v: very loud

. Grade vi: loudest

- pitch: as high ,medium , or low. depends on pressure & rate of bld flow producing murmur
- Quality: as musical ,blowing , harsh, or rumbling
- Location: the area of maximum intensity of the murmur
- Radiation :may be heard in another places on the neck, the back.
- Posture: some disappear or enhanced by change position it may be:

** innocent indicates having valvular or other pathologic causes

** functional is due to increased bld flow in the heart as in anemia, fever, pregnancy .

- Change position: roll pt toward Lt side listen at the apex for presence of any diastolic filling sounds

  sit up pt lean forward & exhale ,check for soft, high- pitched , early diastolic murmur of aortic or pulmonic regurgitation

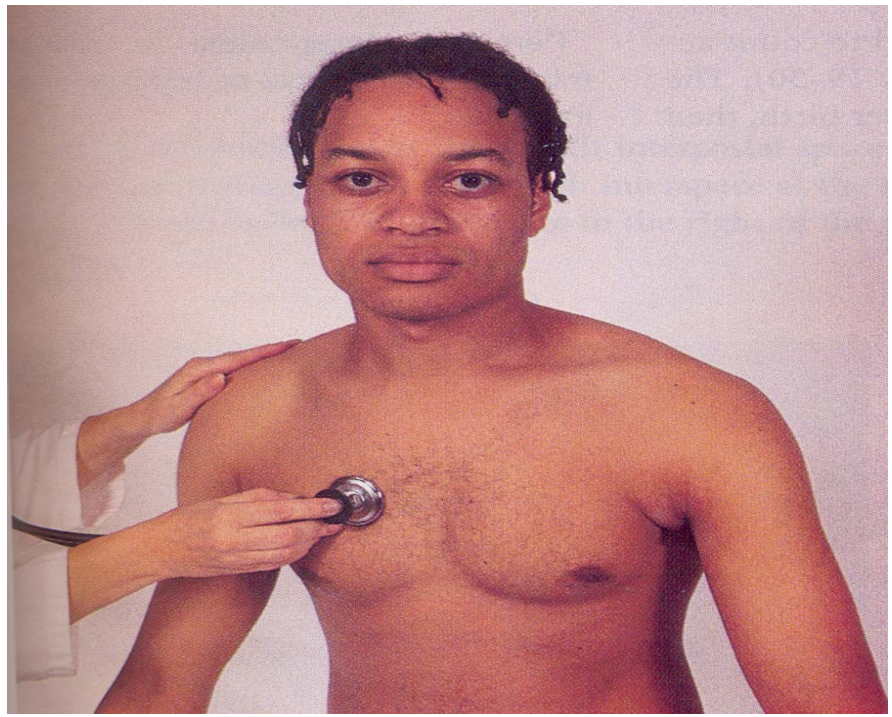
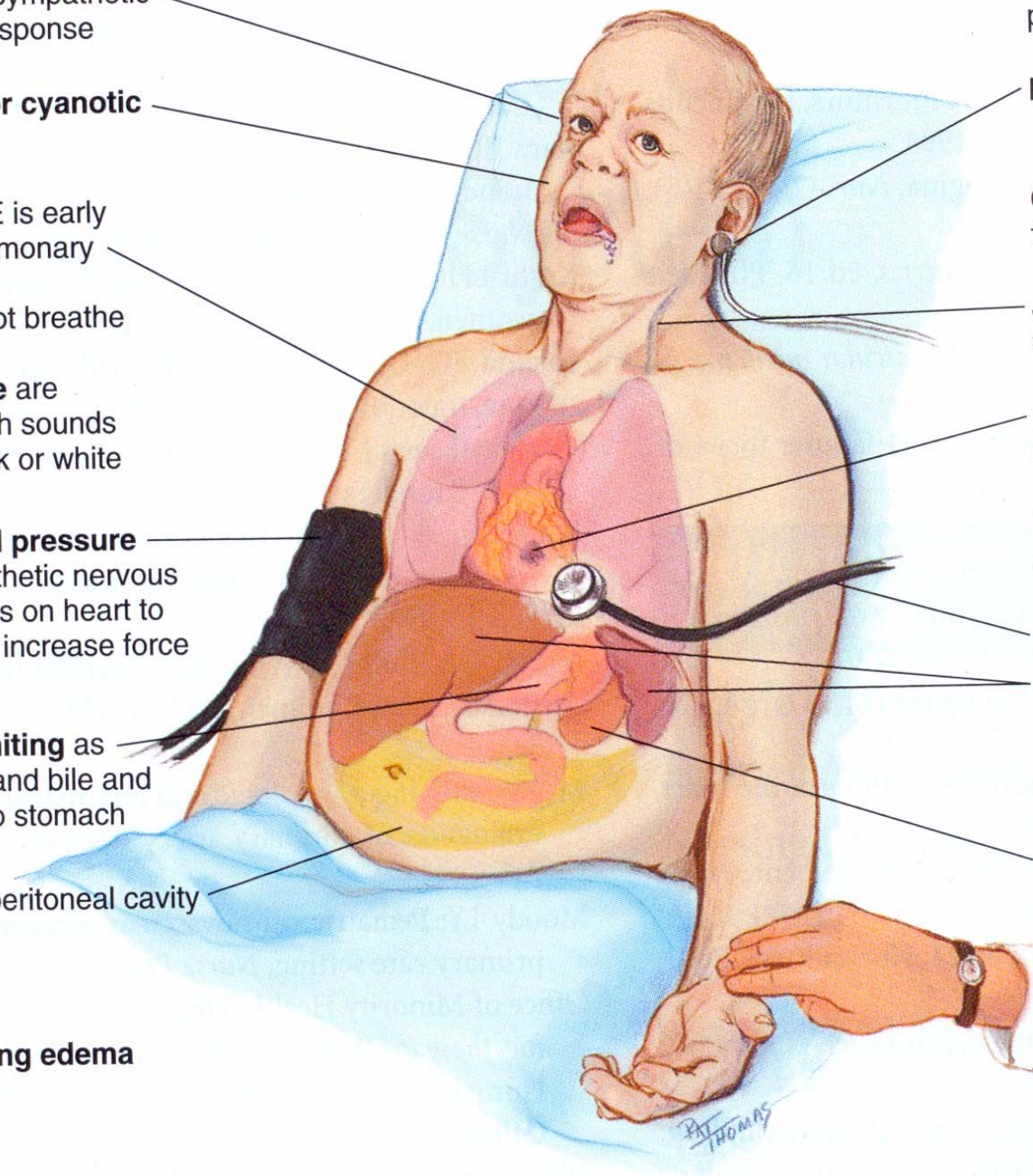


TABLE 19–10: Clinical Portrait of Heart Failure



Dilated pupils, a sympathetic nervous system response

Skin pale, gray, or cyanotic

Dyspnea, SOBOE is early symptom from pulmonary congestion
Orthopnea, cannot breathe unless sitting up
Crackles, wheeze are adventitious breath sounds
Cough, frothy pink or white sputum

Decreased blood pressure stimulates sympathetic nervous system, which acts on heart to increase rate and increase force of contraction

Nausea and vomiting as peristalsis slows and bile and fluids back up into stomach

Ascites, fluid in peritoneal cavity

Dependent, pitting edema in sacrum, legs

Anxiety, gasping from pulmonary congestion

Falling O_2 saturation

Confusion, unconsciousness from decreased O_2 to brain

Jugular vein distention from venous congestion

Infarct, may be cause of decreased cardiac output

Fatigue, weakness from decreased cardiac output

S_3 gallop, tachycardia

Enlarged spleen and liver from venous congestion, which causes pressure on breathing

Decreased urine output as kidneys compensate for decreased CO by retaining sodium and H_2O

Weak pulse
Cool, moist skin as peripheral vasoconstriction shunts blood to vital organs