



TEXAS  
PHYSICAL THERAPY  
ASSOCIATION

# 2019 TEXAS PHYSICAL THERAPY ASSOCIATION ANNUAL CONFERENCE

The Woodlands, TX  
October 12<sup>th</sup>-13<sup>th</sup>

# Conference Overview



## CCU's

Please note that in order to receive continuing education credits, you are required to sign-in **AND** out at each session. You must attend the **entire** session to receive credit. Credit will **NOT** be issued after conference if requested via phone or email for attendees who did not sign-in **AND** out.



## Expo Hall

We thank our exhibitors for supporting the TPTA Annual Conference. Be sure to stop by the expo hall.

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# Vitals are Vital

## Treating patients with Cardiopulmonary Conditions in Outpatient Physical Therapy Settings

**Dr. Germaine Ferreira PT, DPT, MSPT, BHMS.**

**Dr. Hazel Anderson PT, DPT, BScPT (Hons), cert. MDT.**

**Dr. Amy Walters PT, DPT. Board-Certified Clinical Specialist in Geriatric (GCS) and Sports Physical therapy (SCS).**

# Learning Objectives

- ▶ Review Anatomy and Physiology of the Cardiovascular System
- ▶ Review Diagnostics: Electrocardiography + Lab Values
- ▶ Understand Vital Signs - normal and abnormal
- ▶ Understand the Implications for Rehabilitation in the Out-Patient setting

# Case Study

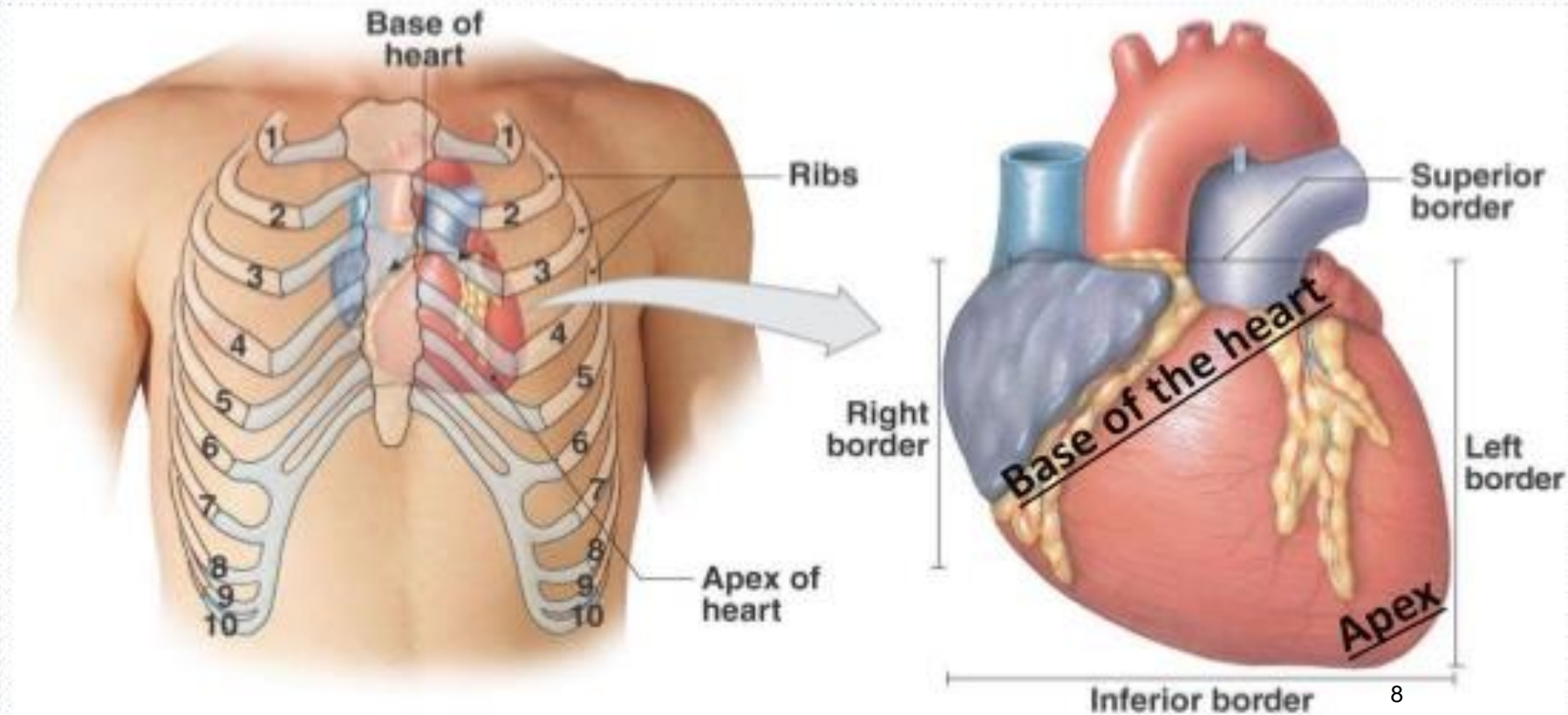
- ▶ Patient X is referred to out patient physical therapy
- ▶ 58 year old librarian
- ▶ 8 days s/p left TKR
- ▶ PMH: HTN, Myocardial infarct a year ago, chronic stable angina
- ▶ Patient is overweight and reports she is very sedentary
- ▶ Meds
  - ▶ Aspirin 81 mg PO once daily
  - ▶ Metoprolol (Toprol-XL) 50 mg PO bid
  - ▶ Amlodipine (Norvasc) 10 mg PO once daily
  - ▶ Hydralazine 25 mg PO tid
  - ▶ Atorvastatin (Lipitor) 20 mg PO once daily
  - ▶ Nitroglycerin (Nitrostat) 0.4 sublingually PRN
  - ▶ Enoxaparin (Lovenox) 30 mg SC q 24 hours

# SECTION 1

## **Anatomy of the Cardiovascular System**

# Thorax Anatomy

## HEART POSITION IN THE THORAX



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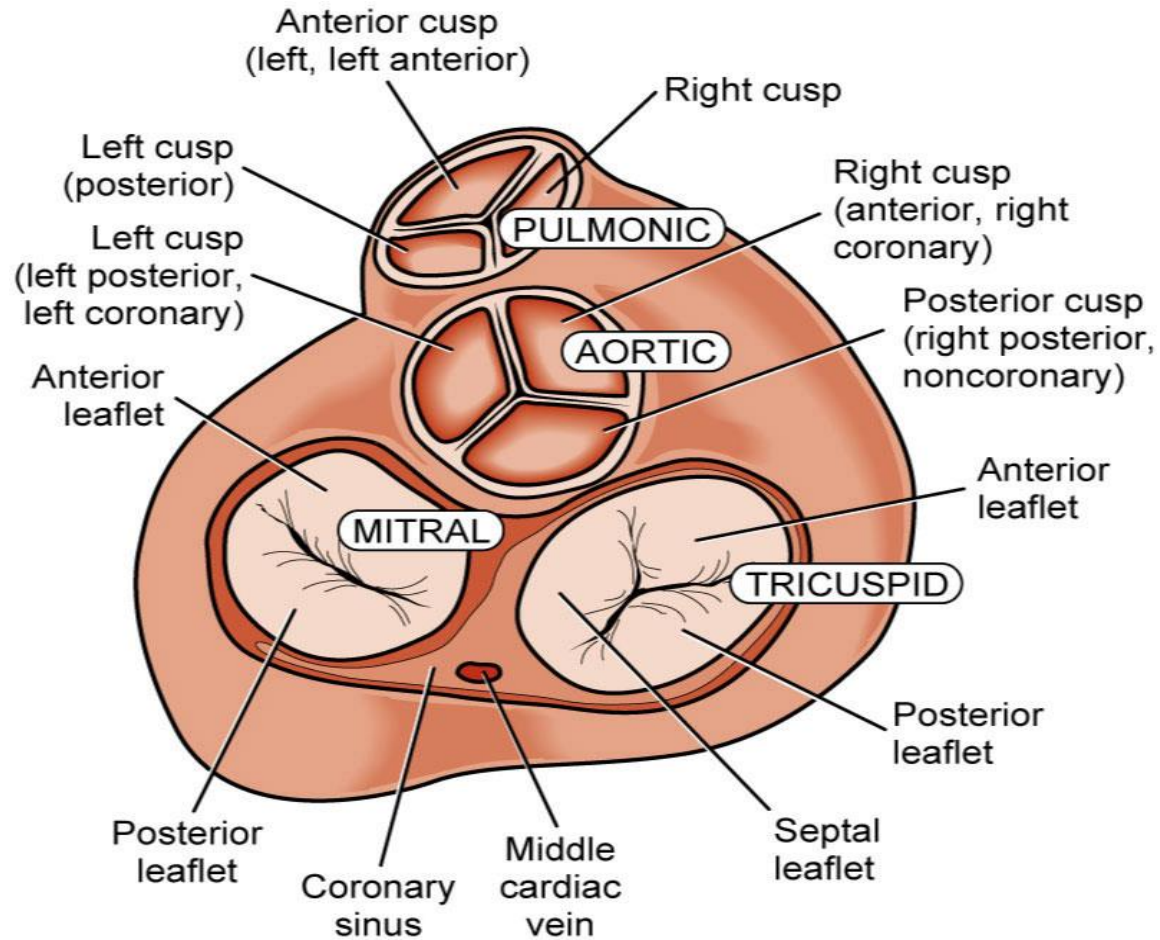
# The Cardiovascular System

## ▶ Heart Walls

- ▶ Pericardium/Epicardium - outer layer
- ▶ Myocardium - middle layer; muscle
- ▶ Endocardium - innermost layer; lining of heart chambers
  - Heart valves



# Chambers and Valves of the Heart



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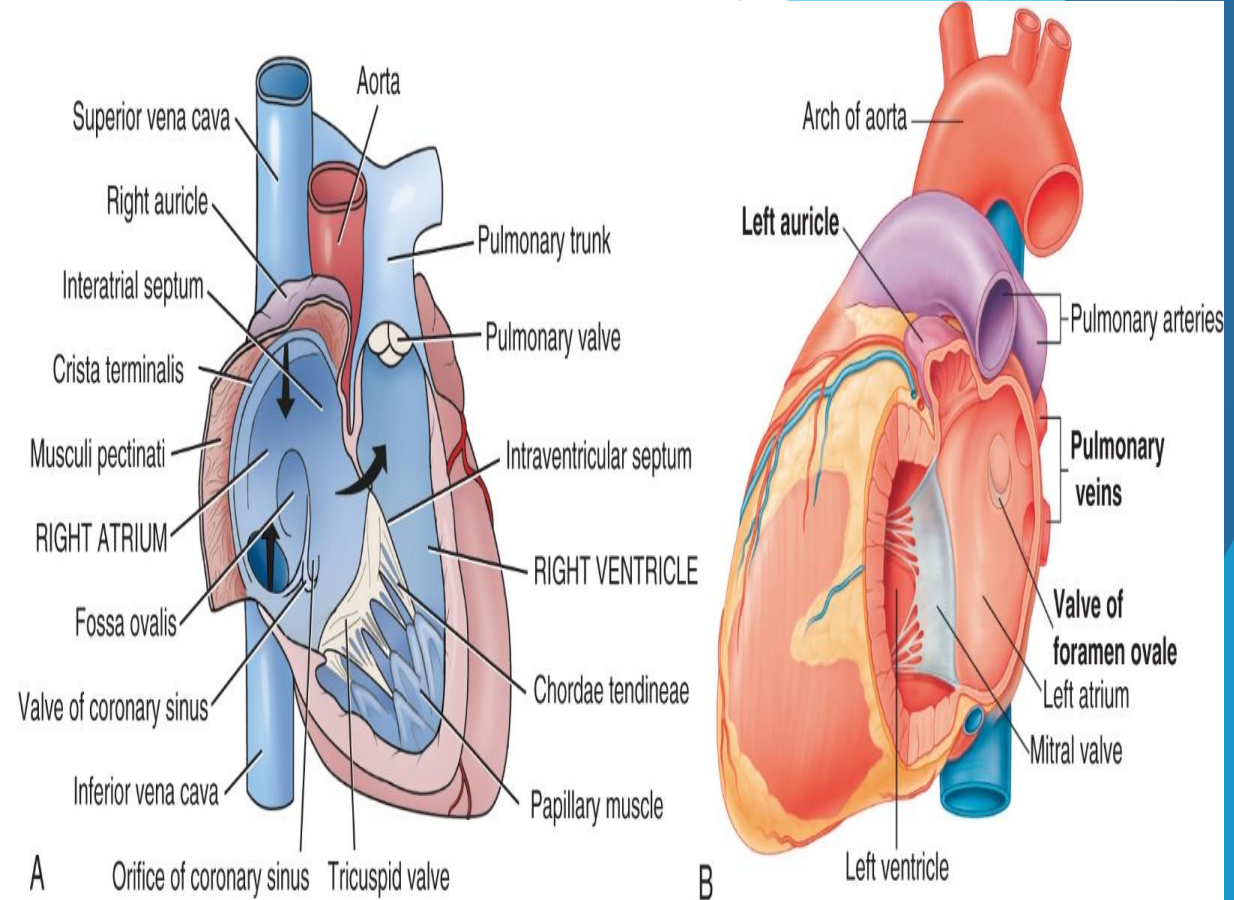
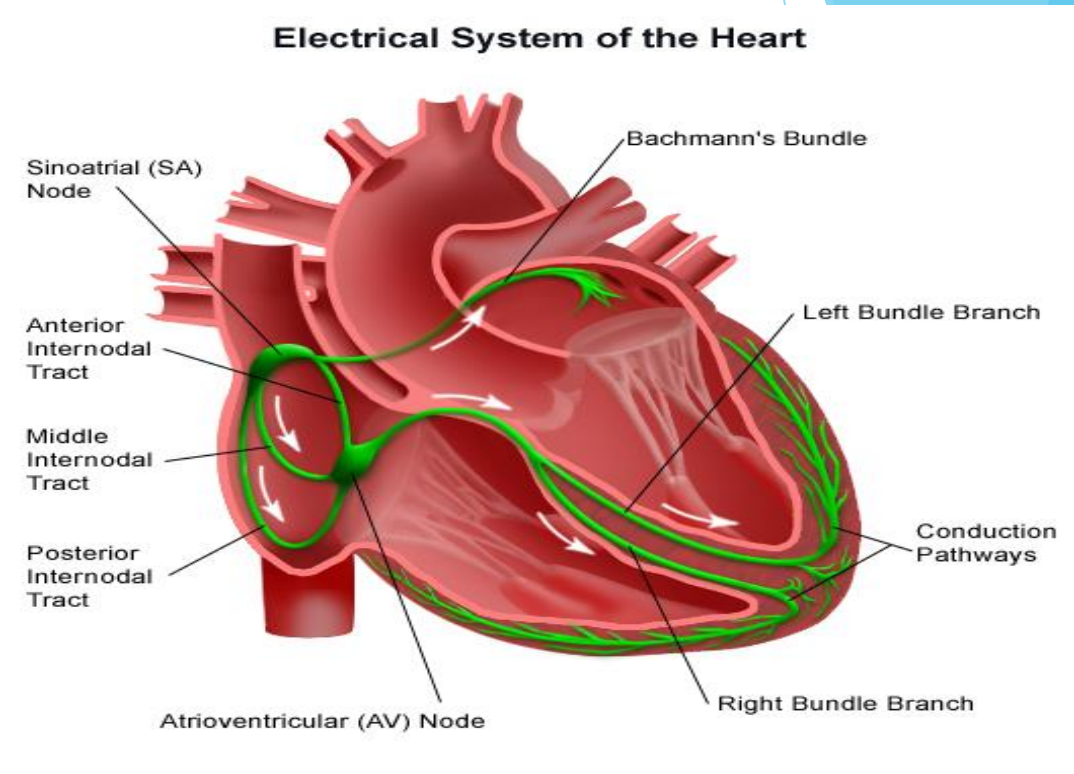


Fig. 1.16. Schematic of the heart. **A**, Right atrium and ventricle. The arrows indicate the flow of blood from the venae cavae to the right atrium and from the right atrium to the right ventricle. **B**, Left atrium and ventricle. The blood flows from the pulmonary veins to the left atrium, through the mitral valve into the left ventricle, and from there into the systemic circulation. Copyright © 2017 by Elsevier, Inc. All rights reserved.

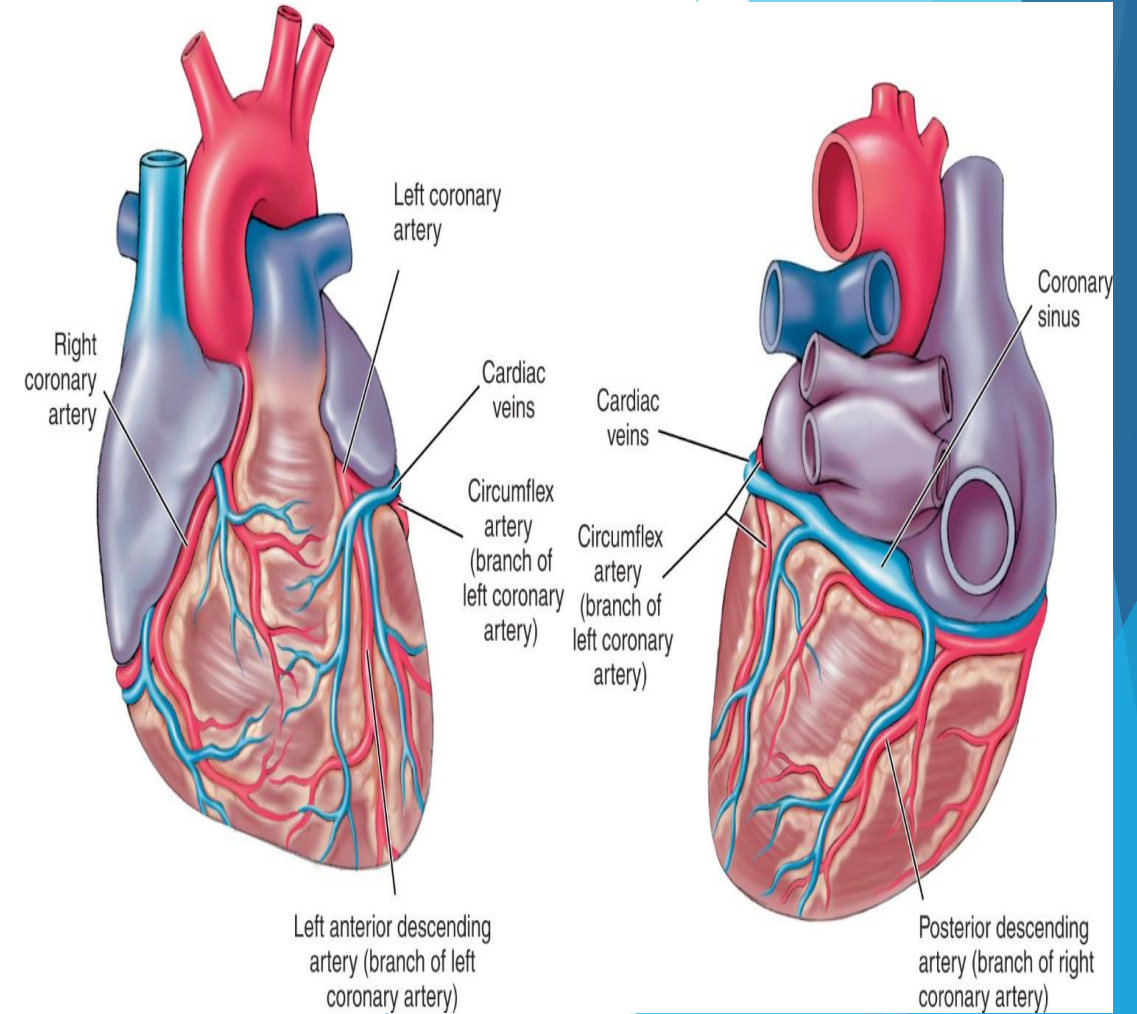
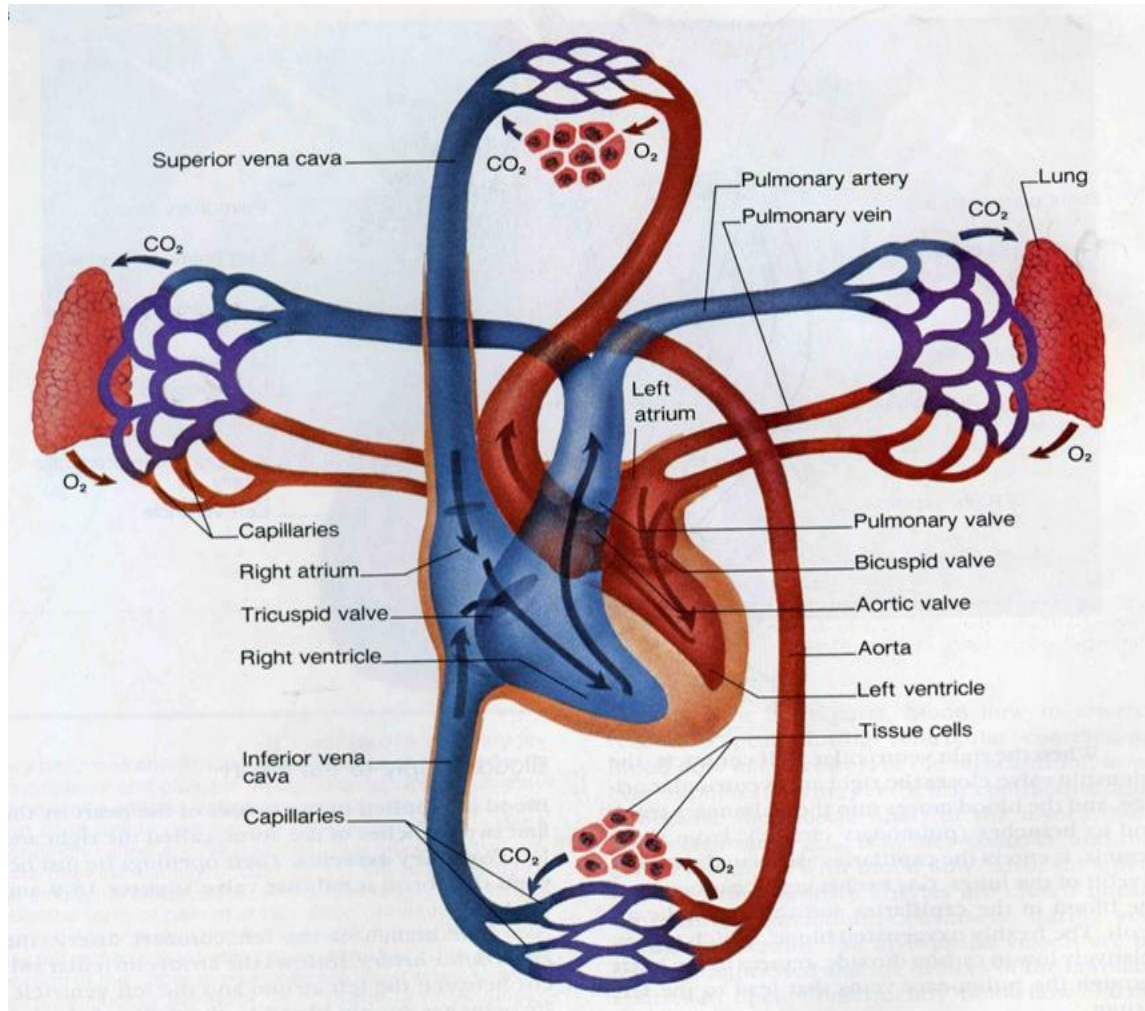
# Conduction System

- ▶ Conduction system
  - ▶ Sinoatrial (SA) node
  - ▶ Atrioventricular (AV) node
  - ▶ Bundle of His
  - ▶ Purkinje
- ▶ Innervation
  - ▶ Parasympathetic
  - ▶ Sympathetic





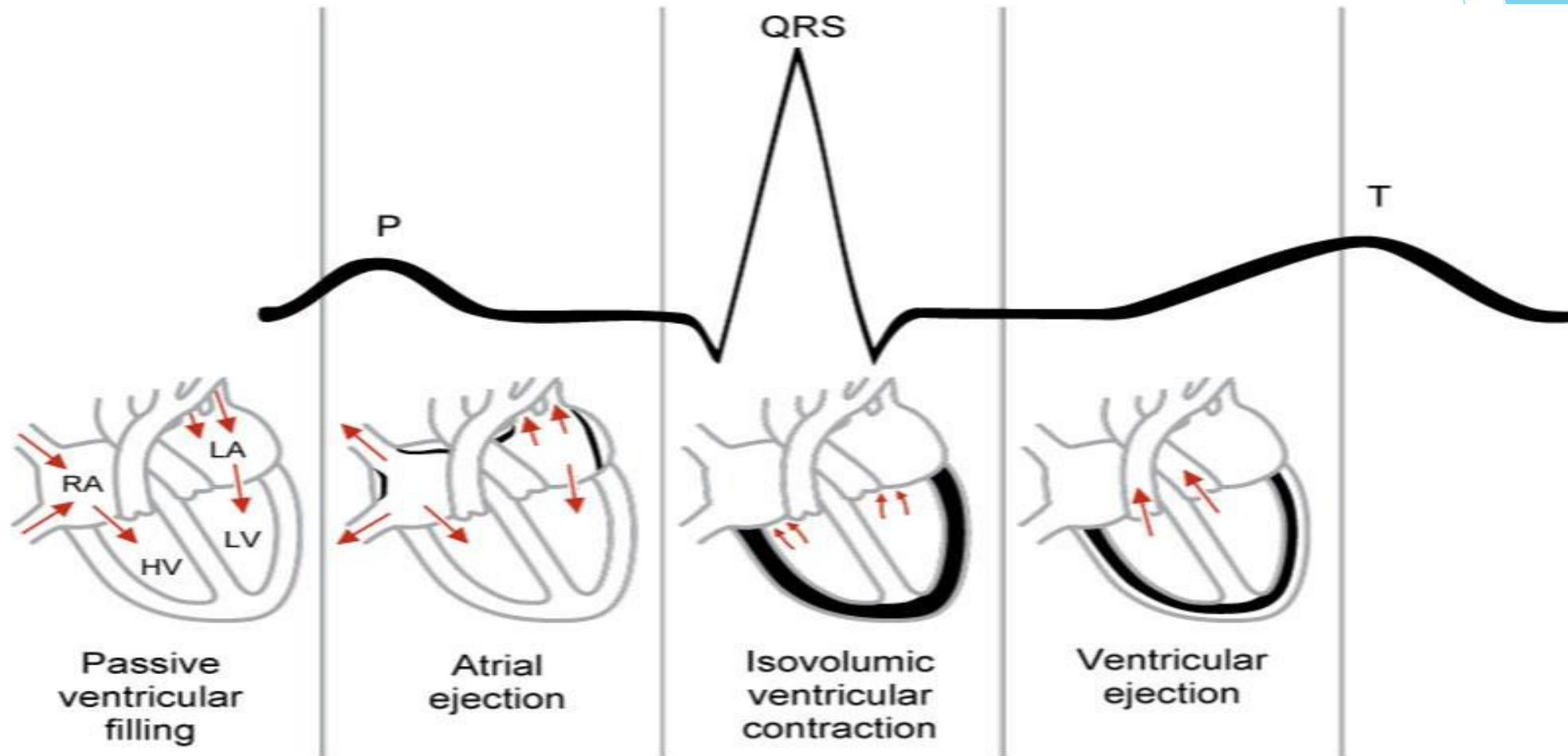
# Circulation



## SECTION 2

# Physiology of the Cardiovascular System

# The Cardiac Cycle



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Fig. 2.14. The mechanical events of the cardiac cycle shown in relation to the electrical events of the electrocardiogram. In late diastole, just prior to the P wave, the ventricles fill passively. At about the time that the P wave ends, the atria contract to eject up to 30% of the end-diastolic ventricular volume. A period of isovolumic ventricular contraction begins very shortly after the onset of the QRS complex. Ventricular ejection coincides with the early portion of the ST segment.

# Cardiovascular Terminology

- ▶ Cardiac Output (CO) = Heart Rate  $\times$  Stroke Volume
- ▶ Stroke Volume (SV)
- ▶ Rate pressure product (RPP) =  $HR \times \text{Systolic BP} / 1000$
- ▶ Heart Rate (HR) - 60 -100 bpm
- ▶ Coronary blood flow - Squeezed during systole, perfuses during diastole
- ▶ Blood flow to muscles during exercise -redirecting from digestive organs/kidneys to skeletal muscle
- ▶ Ejection fraction - 60% to 70% - Ratio of blood ejected out of ventricles to blood received by ventricles
- ▶ Venous return



# Effects of Aging on the Heart

- ▶ Alters functioning of CV system
- ▶ Chronic illnesses and comorbidities further affect functioning
- ▶ Left ventricular wall thickness increases
- ▶ Increased vascular thickness
- ▶ Maximal oxygen uptake and cardiac output reduces
- ▶ Resting HR may be lower



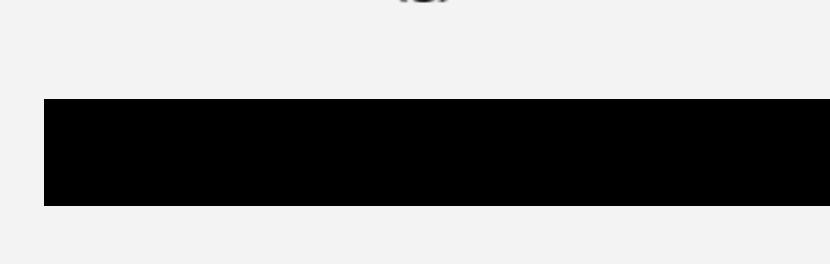
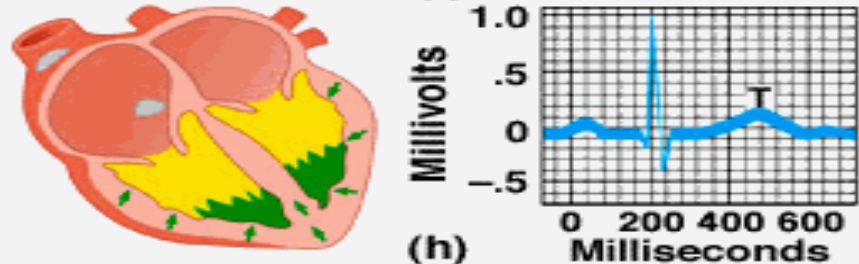
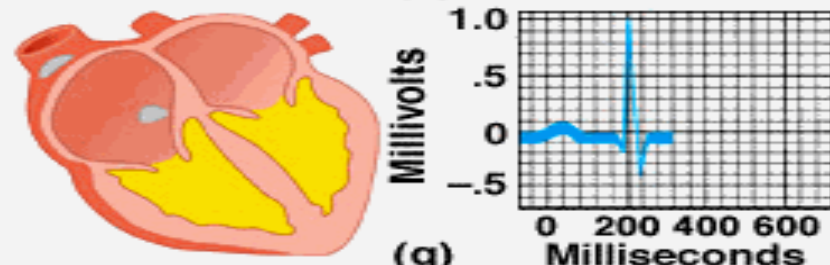
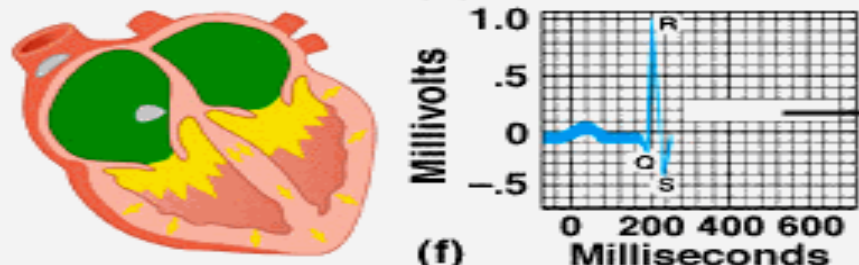
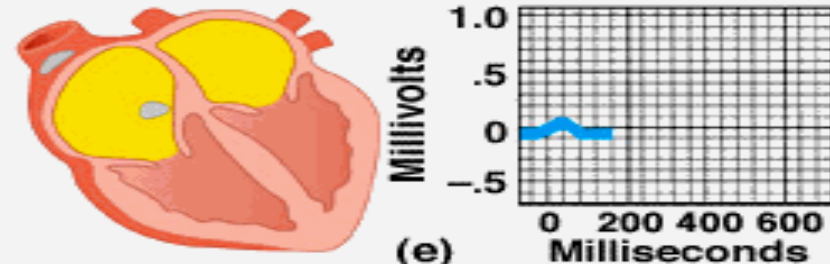
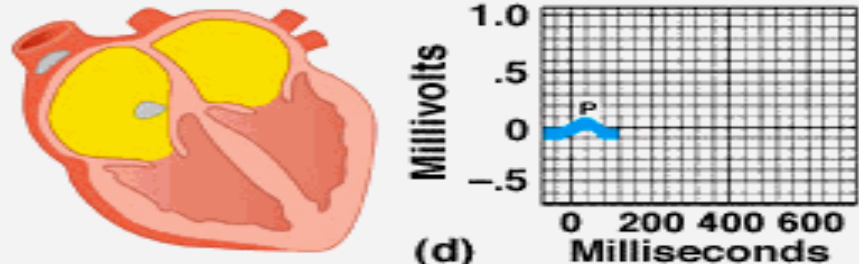
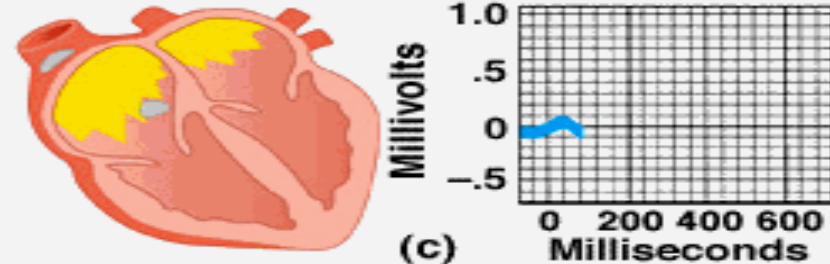
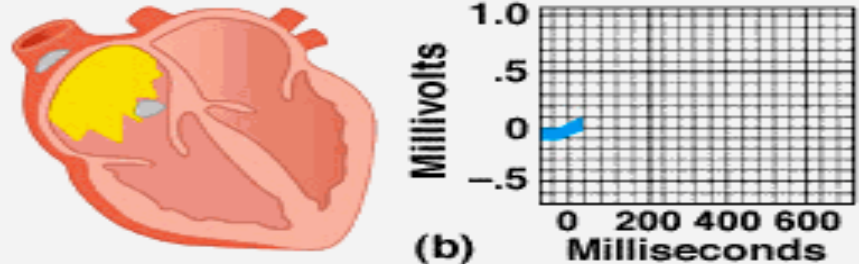


## SECTION 3

# Electrocardiography

# Cardiac Cycle + ECG

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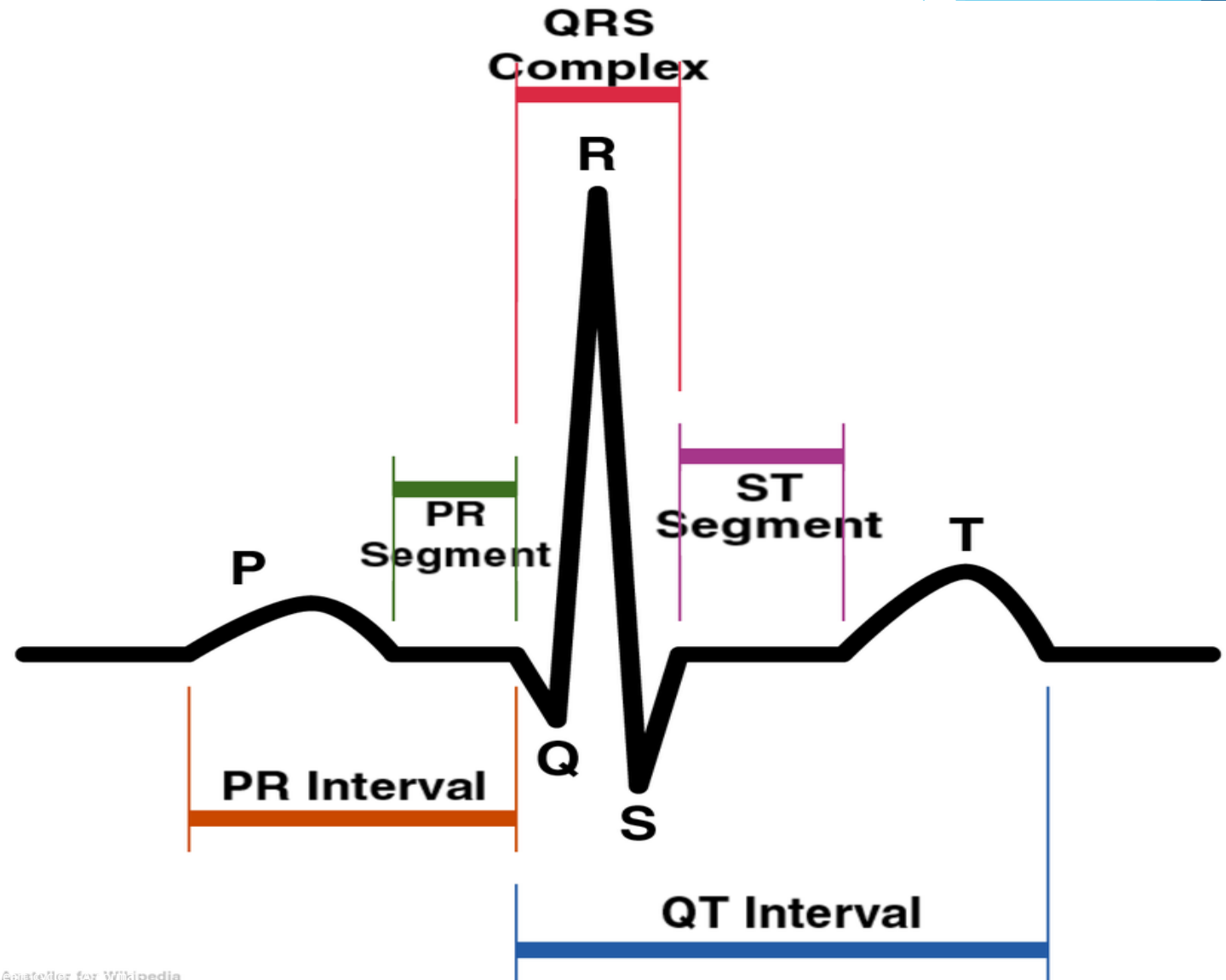


QRS complex



# Normal Sinus Rhythm

- ▶ P Wave
- ▶ QRS Complex
- ▶ ST Segment
- ▶ T Wave



Bradycardia



Tachycardia



Ectopic Foci





## Atrial Flutter

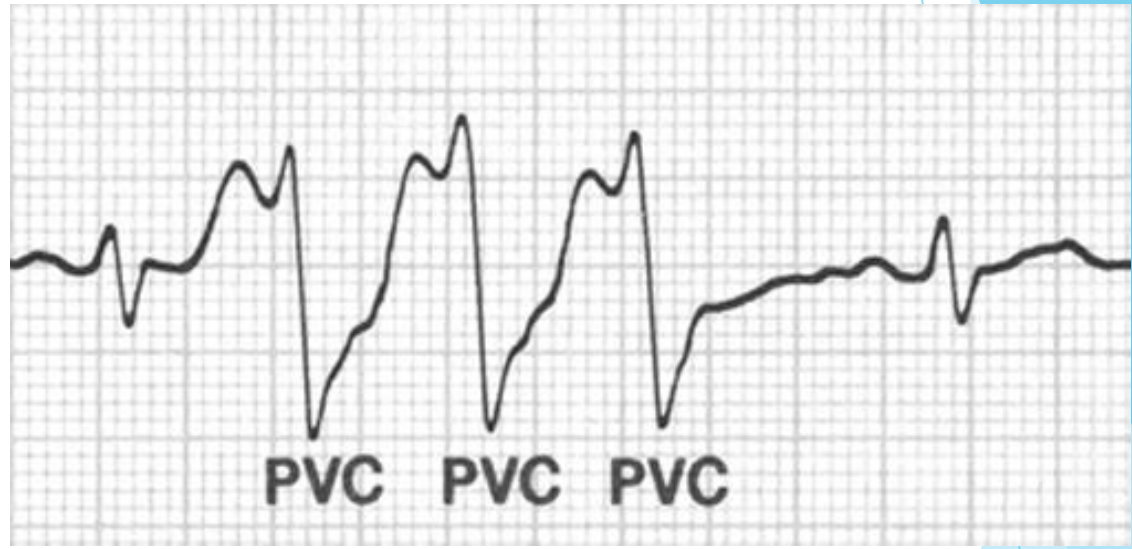


## Atrial Fibrillation



# Ventricular Tachycardia

- Ventricular Focus
- $\geq 3$  Consecutive PVCs
- Rapid HR
- Clinically: fast heartrate and lightheadedness ...
- What to do: AED, call 911



# Ventricular Fibrillation

- Ventricles Twitch
- No Normal ECG Complexes
- Clinically: even more serious



## SECTION 4

# Implications for Rehabilitation





# Exercising an Orthopedic Patient with Cardiopulmonary Issues

- ▶ What to Monitor:
  - ▶ HR
  - ▶ BP
  - ▶ Pulse Oximetry
  - ▶ Respiration Rate?

# Normal Physiological Changes with Activity

## Heart Rate

- ▶ Normal HR increases ( $\leq 200$  bts)
- ▶ Steady HR (plateaus at a given level of intensity)
- ▶ Resting HR lower in a trained exerciser
- ▶ Recovery phase after 1 min HR should drop more than 12 bts

Grade	Pulse	Description
0	Absent	No perceptible pulse
1+	Thready	Barely perceptible, easily obliterated with slight pressure
2+	Weak	Difficult to palpate, slightly stronger than thready, can be obliterated with light pressure
3+	Normal	Easy to palpate; requires moderate pressure to obliterate
4+	Bounding	Very strong , hyperactive

# Normal Physiological Changes with Activity

## Blood Pressure

- ▶ Systolic BP rises in proportion to workload
- ▶ DBP- increase or decrease no more than 10 mm of hg
- ▶ SBP should not continuously rise after 5 minutes
- ▶ Should not see sustained elevation of DBP in recovery phase

Classification	Systolic blood Pressure (mm Hg)	Diastolic Blood Pressure (mm Hg)
Normal	<120	<80
Prehypertension /Elevated	120-129	<80
Stage 1 hypertension	130-139	80-89
Stage 2 hypertension	> 140	>90

# Normal Physiological Changes with Activity

## PULSE OXIMETRY

- ▶ Indirectly measures O<sub>2</sub> saturation in the blood (SpO<sub>2</sub>)
- ▶ SpO<sub>2</sub> should NOT be less than 92%

	NORMAL	ABNORMAL
RESTING	98%- 100%	< 98%
ACTIVITY	No change	Decrease w/activity. <92% exercise is avoided

# Karvonen's Formula

- ▶ Preferred way to calculate heart rate zone
- ▶ Karvonen's = (Max HR - Resting HR) x (desired workload) + Resting HR
- ▶ Max HR is 220 - age

## → What is your ideal heart rate Zone?

Karvonen's = (Max HR - Resting HR) x (desired workload) + Resting HR

# Determining Exercise by Rate of Perceived Exertion (RPE) - BORG SCALE

- ▶ *HR method NOT reliable for patients on beta-blocking or CA+ channel blocking medications.*
- ▶ *Need to use RPE*
- ▶ \* Subjective Scale therefore caution

# RPE

6	Nothing at all		0
7-8	Extremely light (extremely easy)		.5
9	Very light (very easy). For a healthy person, it is like walking slowly at comfortable pace for some minutes		1
10	Easy 40-50%		2
11	Light 40-50% Aerobic Capacity.	Moderate	3
12	Pollock: ratings of 12-13 correspond to approximately 60 - 70% of functional capacity and can be used to establish the recommended training activity. Borg: a rating of 12 to 17 corresponds to a target intensity adequate for an exercise session of 20 to 40 minutes for most age groups.	Somewhat difficult	4
13		Somewhat hard (difficult) but it still OK to continue.	5
14			
15		Hard (heavy)	6
16			7
17	Very hard, strenuous. A healthy person can still go on, but has to push him / herself. It feels very heavy, and the person is very tired.		8
18			9
19	Extremely hard (extremely difficult). For most people this is the most strenuous exercise they have ever experienced.		10
20	Maximal exertion		



# Example - Our Case Study Patient:

- ▶ 58 year old librarian, 8 days s/p left TKR
- ▶ Meds
  - ▶ Aspirin 81 mg PO once daily
  - ▶ **Metoprolol (Toprol-XL) 50 mg PO bid**
  - ▶ **Amlodipine (Norvasc) 10 mg PO once daily**
  - ▶ Hydralazine 25 mg PO tid
  - ▶ Atorvastatin (Lipitor) 20 mg PO once daily
  - ▶ Nitroglycerin (Nitrostat) 0.4 sublingually PRN

# Energy Cost of Various Activities

<b>METs</b>	<b>ACTIVITY</b>
1 - 2	Standing, strolling 1 mph
2-4	Self-care, walking 2 mph, level bicycling 5 mph, bowling, fishing from bank, light calisthenics, golf using cart
4-6	Walking 4 mph, moderate housework, bicycling 10 mph, table tennis, golfing, social and square dancing, fishing by wading in stream, golf walking carrying or pushing bag on wheels
6-8	Jogging 5 mph, bicycling 12 mph, hill climbing, downhill skiing
8-10	Running (6mph)-Running (9mph), mountain climbing
10-12	Swimming >40 yds./min., basketball, racquetball

# EXERCISE PRESCRIPTION: TIME (DURATION)

- ▶ Goal: 20-30 minutes if moderate intensity  
40-60 minutes if low intensity
- ▶ When time is not available, try a number of 10-15 min periods throughout the day

# EXERCISE PRESCRIPTION: FREQUENCY

- ▶ dependent on intensity and duration
  - ▶ 3 to 5 days/week at moderate intensity
- ▶ If continuous exercise duration is <15-20 minutes, frequency should be 2-3 times/day
- ▶ If continuous exercise duration is >20 minutes, frequency can be once a day, 3-7 days/week, depending on the intensity
  - ▶ Low-to-moderate intensity  $\Rightarrow$  5-7 days / week
  - ▶ Higher intensity  $\Rightarrow$  3-5 days / week

# DYSPNEA LEVEL

Able to Count to 15 in a 7.5 - 8 second period

- ▶ Level 0 - On a single breath
- ▶ Level 1 - Requires two breaths
- ▶ Level 2 - Requires three breaths
- ▶ Level 3 - Requires four breaths
- ▶ Level 4 - Unable to count

# The Angina Scale

<b>1 +</b>	Light, barely noticeable
<b>2 +</b>	Moderate, bothersome
<b>3 +</b>	Severe, very uncomfortable
<b>4 +</b>	Most severe pain ever experienced

- Location / distribution of the pain
- Duration of the pain
- Exercise intensity at its onset



# Exercise Contraindications

## Relative Contraindications

- ▶ Rapid weight increase in 1-3 days
- ▶ Supine resting HR > 100 bpm
- ▶ Ventricular arrhythmias at rest or with exertion (past 3 days)
- ▶ Decrease in SBP with exercise

## Absolute Contraindications

- ▶ Significant angina below 2 METS
- ▶ New onset atrial fibrillation

## SECTION 5

# Commonly Encountered Cardiovascular Conditions

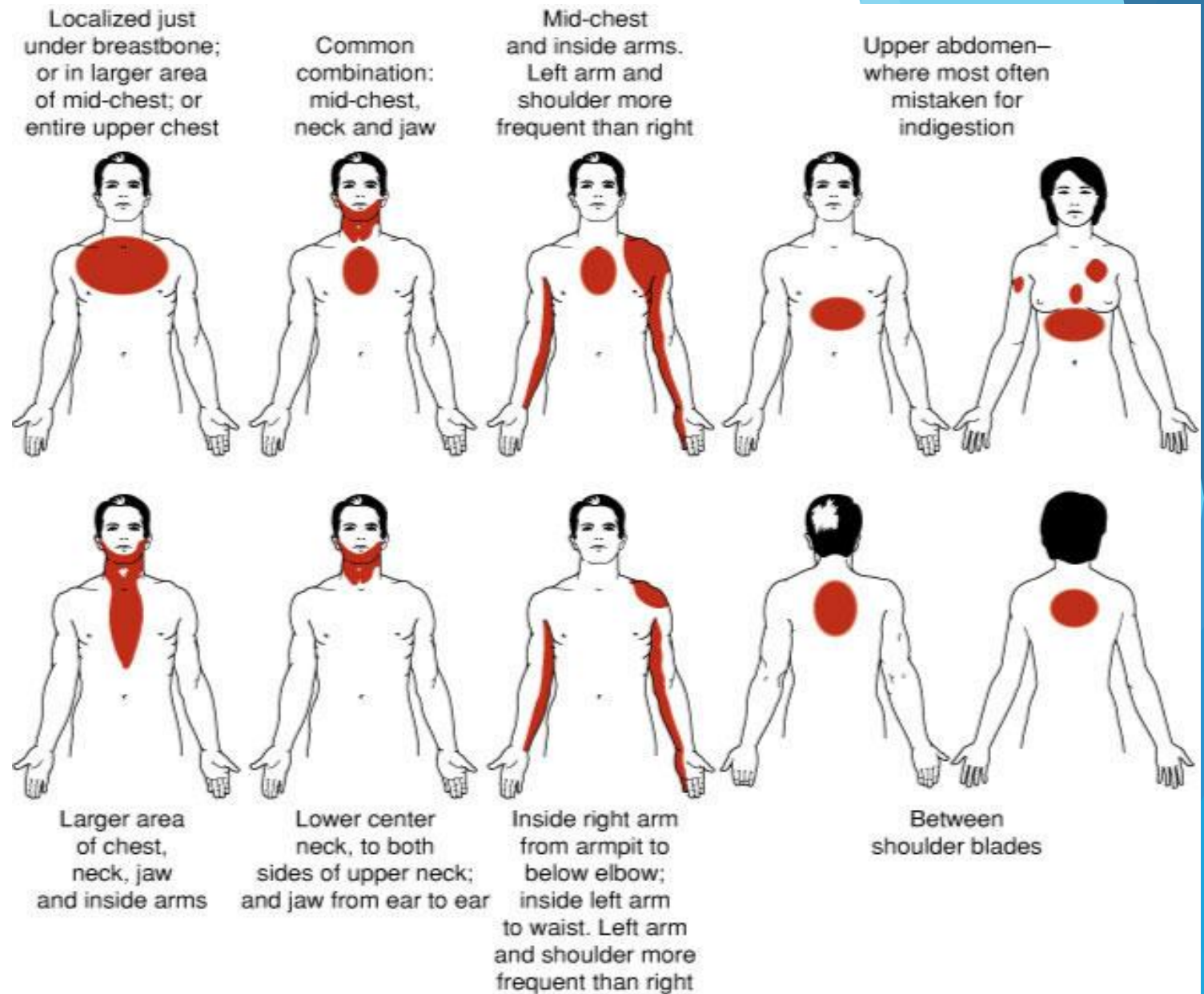


# Common Outpatient Cardiovascular Conditions

- ▶ Angina - stable and unstable
- ▶ Hypertension
- ▶ Heart Failure

# Angina

- ▶ Substernal pressure, pain
- ▶ Squeezing, tightness, or crushing
- ▶ Pain that spreads to the throat, neck, back, jaw, arm
- ▶ Caused by imbalance in supply and demand of myocardial oxygen



# Angina

## ▶ Chronic stable angina

- Well-established level of onset
- Result of not enough blood supply to meet metabolic demand
- Usually can control symptoms by reducing the intensity of exercise or taking sublingual nitroglycerin

## ▶ Unstable angina / Acute coronary syndrome

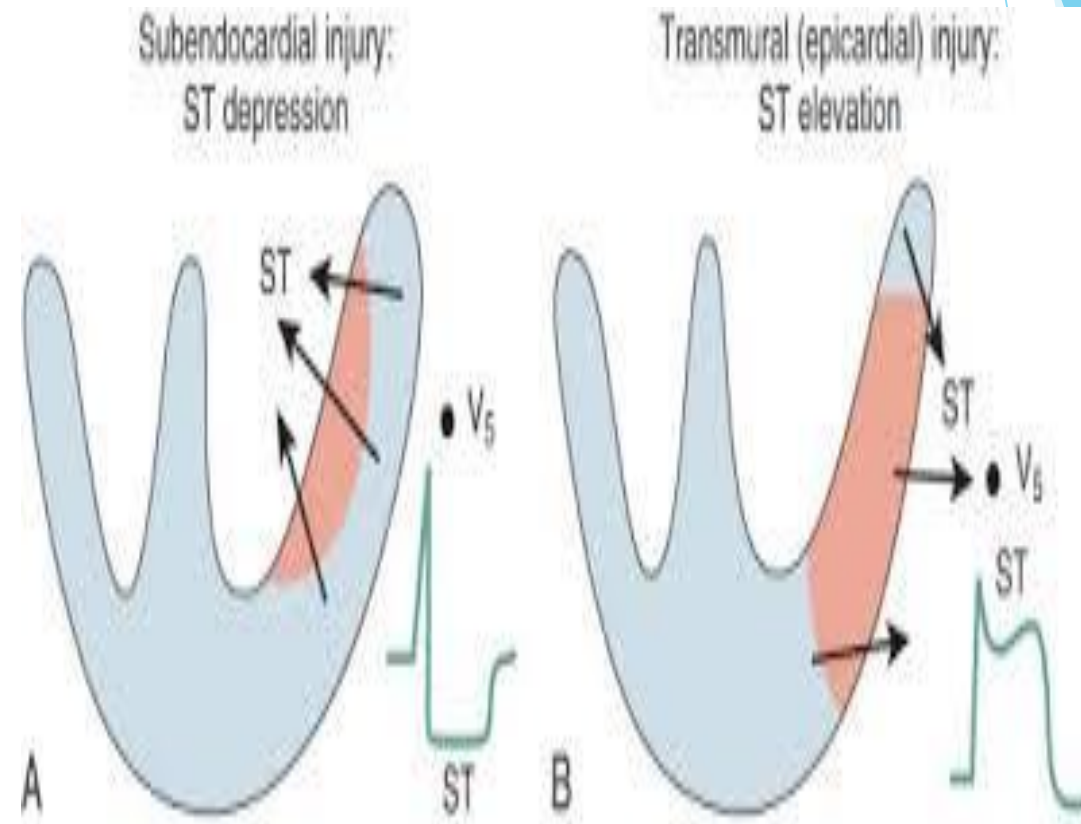
- ▶ chest discomfort that is accelerating in frequency or severity, may occur at rest
- ▶ Acute myocardial infarction
  - ▶ ST-segment elevation myocardial infarction (STEMI)
  - ▶ Non-STEMI

# Unstable Angina → Myocardial Ischemia

- ST Segment Depression
- Transient
- Responds to rest and nitroglycerine

# Myocardial Ischemia → Myocardial Infarct

- ▶ ST elevation (STEMI)
  - ▶ Full thickness
  - ▶ Troponin changes
- ▶ ST depression (NonSTEMI)
  - ▶ Sub endocardial injury
  - ▶ Troponin changes
  - ▶ T wave - variable



# Common Cardiac Meds- Angina

- ▶ Organic Nitrates- nitroglycerin
  - ▶ Produce general vasodilation not just coronary vessels
  - ▶ Modes of administration- sublingual, nasal, oral, patches, ointment
  - ▶ AE- tolerance with patches, HA, dizziness, OH
- ▶ Beta adrenergic blockers- propranolol (Inderal)
  - ▶ Decrease heart rate decreasing myocardial oxygen demand
  - ▶ AE- bronchoconstriction (need cardio selective BB if have asthma)
- ▶ Calcium channel blockers- Nifedipine (Adalat)
  - ▶ Decrease calcium entry causing coronary vasodilation (some peripheral vasodilation as well)
  - ▶ Good for patients with angina and arrhythmias
  - ▶ AE- HA, flushing, dizziness, inc risk MI, cancer?, reflex tachycardia
- ▶ Anticoagulants/antiplatelets- heparin or aspirin
  - ▶ Especially with unstable angina



# Hypertension

- ▶ Based on **new** American Heart Association (AHA) **guidelines** for the detection, prevention, management and treatment of high **blood pressure**.  
Nov 13, 2017
- ▶ 130/80 is now considered high blood pressure, according to new guidelines.  
140/90 was previously defined as high blood pressure.

BP Category	SBP		DBP
Normal	<120 mm Hg	and	<80 mm Hg
Elevated	120-129 mm Hg	and	<80 mm Hg
Hypertension			
Stage 1	130-139 mm Hg	or	80-89 mm Hg
Stage 2	140 mm Hg	or	90 mm Hg

# Treatment of Hypertension

## ▶ Pharmacological Therapy

## ▶ Lifestyle modifications

- ▶ Weight reduction
- ▶ Less Salt
- ▶ Regular Aerobic exercise
- ▶ Moderate alcohol consumption

- ▶ Exercise capacity is reduced by 15% to 30%

Regular exercise promotes

- ▶ Stroke volume increases abnormally
- ▶ peak heart rate is lower reducing cardiac output
- ▶ reductions in both systolic and diastolic BP

\*exercise should emphasize lower extremity over upper extremity

# Drugs for hypertension

- ▶ ACE inhibitors-
  - ▶ Adverse Effect -causes dry cough
- ▶ Beta Blockers
  - ▶ Adverse Effects - bradycardia, Orthostatic Hypotension
- ▶ Diuretics
  - ▶ Adverse Effects - dehydration and electrolyte imbalance
- ▶ Vasodilators- For severe congestive HF
  - ▶ Adverse Effects - reflex tachycardia, dizziness, Orthostatic Hypotension

# Hypertension “Take Home” Points

- ▶ Many patients referred to physical therapy will have unrecognized HTN
- ▶ Vitals should be monitored during treatment sessions
- ▶ Refer to physician when:
  - ▶ Resting SBP >200 mm Hg
  - ▶ Resting DBP >100 mm Hg

# Heart Failure:

- ▶ A syndrome characterized by impaired cardiac pump function with inadequate systemic perfusion and an inability to meet the body's metabolic demands
- ▶ 8 million heart failure patients by 2030
- ▶ **Signs and Symptoms**
  - Dyspnea
  - Fatigue
  - Cough
- ▶ Ejection fraction
  - Reduced
  - Preserved
- ▶ EKG Changes
  - Systolic- LVH
  - Diastolic- RVH

# Medications for Heart Failure

- ▶ ACE inhibitors-
  - ▶ Adverse Effect -causes dry cough
- ▶ Beta Blockers
  - ▶ Adverse Effects - bradycardia, Orthostatic Hypotension
- ▶ Diuretics
  - ▶ Adverse Effects - dehydration and electrolyte imbalance
- ▶ Vasodilators- For severe congestive HF



# Exercising a Patient with Heart Failure

- ▶ Exercise prescription
- ▶ Aerobic exercise
- ▶ Strength training
- ▶ Ventilatory muscle training
- ▶ Activity pacing and energy conservation
- ▶ Education of patients



# Exercising a Patient with HF

## Exercise Prescription

- ▶ Low level exercise if hemodynamically stable

## Aerobic Exercise

- ▶ Low intensity, low impact (may start at 40% of THRR progress to 60-80%)
- ▶ Gradual progression of intensity, frequency and duration
- ▶ Start with 2x week progressing towards 3-5 times a week
- ▶ 10-20 mins gradually progress to 30-40 minutes
- ▶ Gradually progress on the Borg scale from 9-14

## Strength Training

- ▶ Low level resistance training
  - ▶ 60-80% of 1 Rep Max, 8-15 reps, 1-3 sets, 3 minutes of rest in between
- ▶ TheraBand for UEs
- ▶ LE resistance with light weights

# Exercising a Patient with Heart Failure

## Ventilatory Muscle Training

- ▶ Breathing exercises
  - ▶ Diaphragmatic breathing
  - ▶ Pursed lip breathing
  - ▶ Positive end- expiratory pressure
  - ▶ Threshold Inspiratory Muscle Trainer

## Activity Pacing and Energy Conservation

- ▶ Take frequent rest intervals
- ▶ Participate in activities which consume more energy when the patient has more energy
- ▶ Avoid and delegate some activities
- ▶ Alternate easy and difficult tasks
- ▶ Sit between strenuous activities

# References

- ▶ Liebzeit D, Phelan C, Moon C, Brown R, Bratzke L. Rest-Activity Patterns in Older Adults with Heart Failure and Healthy Older Adults. *J Aging Phys Act*. 2017;25(1):116-122. doi:10.1123/japa.2016-0058.
- ▶ Parker RB, Nappi JM, Cavallari LH. Chronic Heart Failure. *Pharmacother A Pathophysiol Approach*, 10e. 2017;21(1):40-43. <http://accesspharmacy.mhmedical.com/content.aspx?aid=1138153541>.
- ▶ De Sousa M, Oliveira J, Soares M, De Araujo A, Oliveira S. Quality of life of patients with heart failure: Integrative review. *J Nurs UFPE Line*. 2017;11(3):1289-1298. doi:10.5205/reuol.10544-93905-1-RV.1103201720.
- ▶ Evans MM. Symptom Recognition and Healthcare Utilization in Adult Patients with Heart Failure : An Integrative Review of the Literature. 2016;25(5).
- ▶ Cook JC, Tran RH, Patterson JH, Rodgers JE. Evolving therapies for the management of chronic and acute decompensated heart failure. *Am J Heal Pharm*. 2016;73(21):1745-1754. doi:10.2146/ajhp150635.
- ▶ Waring T, Gross K, Soucier R, ZuWallack R. Measured Physical Activity and 30-Day Rehospitalization in Heart Failure Patients. *J Cardiopulm Rehabil Prev*. 2016:124-129. doi:10.1097/HCR.0000000000000204.
- ▶ Goodman CC, Fuller KS. *Pathology. Implications for the Physical Therapist*. 4th ed. St. Louis, MO: Elsevier Saunders; 2015.
- ▶ Hillegass E. *Essentials of Cardiopulmonary Physical Therapy*. 4th ed. St. Louis, MO: Elsevier; 2017.
- ▶ Williams B, 2018 ESC/ESH Guidelines for the management of arterial hypertension. Journal of Hypertension: [October 2018 - Volume 36 - Issue 10 - p 1953-2041](#) doi: 10.1097/HJH.0000000000001940
- ▶ Fletcher et al. **Exercise Standards for Testing and Training: A Scientific Statement From the American Heart Association.** *Circulation*. 2013



# Thank You for Attending



- ▶ Be sure to sign-out **before** leaving the session. Credit will NOT be issued after conference if requested via phone or email for attendees who did not sign-in **AND** out.

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- ▶ Course Evaluations are available at every session and may be returned to the Course Proctor or TPTA Registration Desk.

See you next year for Annual Conference 2020!  
The Westin Irving Convention Center Hotel at Las Colinas  
October 30<sup>th</sup> -31<sup>st</sup>, 2020





## Cast Your Vote:

TPTA Voting for professionals will be open:

**Saturday, October 12<sup>th</sup>, 8am – 1:30pm** for members who have not already cast a ballot.

Voting booths are in the Expo Hall.