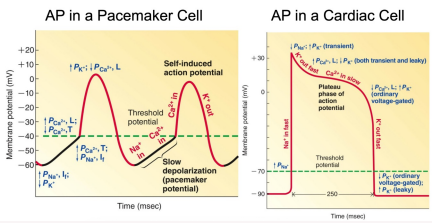
Cardiovascular System Cheat Sheet

by tfayed via cheatography.com/213577/cs/46484/

System Overview

The three principal components: Heart (the pump) Blood vessels (the pipes) Blood (the fluid to be moved) Functions: Supply oxygen/nutrients, remove waste, regulate temperature, distribute hormones, immuno-vigilance

Comparison: PM vc CC



Electrical Activity & Autorhythmicity

Autorhythmic Cells: 1% of heart, initiate APs

Contractile Cells: 99%, mechanical pumping

Pacemaker Activity:-

1. Funny channels: (Na^+ in) and K^+ channels close.

2. T-type Ca^{2+} channels open

3. Threshold: L-type Ca^{2+} channels open

4. Repolarization: K^+ channels open

Note that: : Long refractory period coincides with plateau (Prevents summation/tetanus)

Contractile Cell Action Potential

Type of Cell: Contractile (99% of cardiac cells)

Resting potential: –90 mV

1. Depolarization: Fast Na^+ channels open

2. Initial Repolarization: Transient K^+ channels open

3. Plateau: L-type Ca^{2+} channels open, reduced K^+ efflux

4. Repolarization: Regular K^+ channels open

Return to Rest: Leaky K^+ channels restore resting potential

Pacemaker vs. Cardiac cell

Conduction Pathway

1. SA nodes

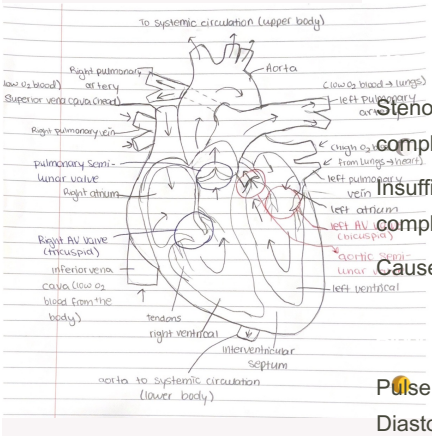
2. AV nodes

3. Bundle of his

4. Right/left bundle branches

5. Purkinje fibers

Structure of the Heart & bloodflow



Anatomy of the Heart

Cardiac Cycle & Heart Sounds Phases:

S1 (“lub”) = AV valves close

S2 (“dub”) = Aortic/pulmonary valves close

Murmur: Stenotic or insufficient valves → turbulence

Phases: Mid-to-late diastole → Ventricular systole → Early diastole

Valve Disorders

Stenotic = valve doesn’t open completely

Insufficient = valve doesn’t close completely

Causes murmurs (turbulent flow)

Pressure

Pulse Pressure = Systolic – Diastolic

Mean Arterial Pressure (MAP) = Diastolic + ⅓(Pulse Pressure)

Measured by: Sphygmomanometer (Korotkoff sounds)

Blood pressure during dynamic exercise

Systolic increases

Diastolic ~same

MAP increases progressively

Blood Flow

Cardiac Output

CO = Heart Rate × Stroke Volume

Stroke Volume = EDV – ESV

Regulation: 2 Types

Type 1: Intrinsic: Frank–Starling Law = Increased venous return increases ventricular filling (increased EDV), which results in a larger stroke volume due to the length–tension relationship.

Extrinsic: Sympathetic stimulation → ↑ , contractility → ↑ SV

MAP Regulation

MAP = C.O x TPR

Contributors: Stroke vol.,Heart rate, Blood Vol., Blood Viscosity, Arteriolar Radius, Sympathetic/-Parasympathetic activity

ECG Components

P wave: Atrial depolarization

PR segment: AV node delay

QRS complex: Ventricular depolarization (atrial repolarization hidden)

T wave: Ventricular repolarization

TP interval: Ventricles relaxing/-filling

ST segment: Ventricles contracting/emptying

ECG wave

Pacemaker: gradual depolarization, no true resting potential, Ca^{2+}-dependent spike	Contractile: stable resting potential, Na^{+}-dependent spike, plateau from L-type Ca^{2+}

Heart Wall Layers:

Endocardium: Inner layer, lines chambers

Myocardium: Cardiac muscle layer, responsible for contraction

Epicardium: Outer layer, also part of pericardium

Pericardium: Protective sac around the heart

Valve Composition:

Connective tissue: Mostly collagen, provides structural support

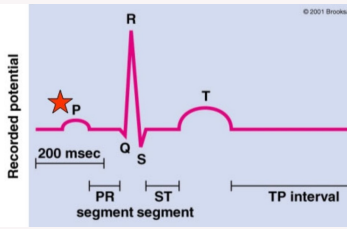
Endothelium: Inner lining of heart and blood vessels

Heart Structure & Blood Flow

4 Heart Valves: Tricuspid, Pulmonary, Mitral, Aortic Flow Sequence: Right atrium → Right ventricle → Lungs → Left atrium → Left ventricle → Body Oxygenation: Pulmonary arteries = O_2-poor, Pulmonary veins = O_2-rich

Flow influenced by: Radius (power of 4 effect), Length, Viscosity

Pressure gradient = Flow × Resistance



ECG Abnormalities

Rate: Tachycardia

Rhythm: Extrasystole, ventricular fibrillation

Conduction: Complete heart block

Myopathies: Myocardial infarction

Capillary exchange

Lipid-soluble substances: pass through endothelial cells

Small water-soluble substances: pass through pores

Exchangeable proteins: moved via vesicular transport

Plasma proteins: generally cannot cross capillary wall

Net Filtration Pressure (NFP)

NFP = Capillary Hydrostatic Pressure − Blood Colloid Osmotic Pressure

Affects direction of fluid movement (filtration vs. reabsorption)

Positive NFP = fluid pushed out (filtration)

Negative NFP = fluid pulled in (reabsorption)

Baroreceptor Reflex

Stimulus: ↑ or ↓ blood pressure

Sensors: Carotid sinus and aortic arch

2 effects can occur:

↑ BP =↑ afferent firing = ↓ HR, ↓ contractility & vasodilation

↓ BP = ↓ afferent firing =↑ HR, ↑ contractility & vasoconstriction

Veins & Venous Return

Valves prevent backflow

Factors that facilitate return:

Sympathetic stimulation, Skeletal muscle pump, Respiratory activity, Increased blood volume.

Exercise Physiology: Cardiovascular Response

Systole and diastole both decrease, but diastole decreases more

Systolic & MAP increase; diastolic remains about the same

Cardiac output shifts to muscles, heart, skin