BIO 2402 - Human Anatomy & Physiology
Week 6
Hi everyone! I hope your first exam went well! This week we are going to be focusing on the heart and the EKG. If you have any questions please let me know!

Remember that the Tutoring Center offers free individual and group tutoring for this class. Our Group Tutoring sessions will be every Wednesday from 6:00-7:00 PM CST. You can reserve a spot at https://baylor.edu/tutoring.

KEY TERMS: Cardiac Conduction Fibers, Cardiac Contractile Cells, Pacemaker cells, Cardiac cycle, cardiac conduction system

Types of cardiac muscle cells:

Cardiac Conduction Fibers: Do not contain sliding filaments, but they do act similarly to nerves and speed up the conduction of action potentials in the cardiac conduction system.

Action Potentials & Conduction fibers: Conduction fibers do not experience action potentials, they act as conducting fibers to speed up APs from pacemaker cells to contractile cells.

Pacemaker Cells: sets heart rate, also known as autorhythmic cells. Pacemaker potential due to Na^+ inflow Rapid depolarization due to Ca^{+2} inflow Repolarization due to K^+ outflow Refractory period during AP; cells cannot depolarize again until repolarization is complete

Action Potentials & Pacemaker Cells: PMCs have unstable membrane potentials due to Na+ leaking into the cell. The leaking sodium creates a pacemaker potential, which appears as a steady slope on the graph below. Once threshold is reached, fast voltage-gated Ca2+ channels open and create an action potential. Finally, voltage-gated K+ channels open and reverse the membrane potential by repolarizing the membrane.

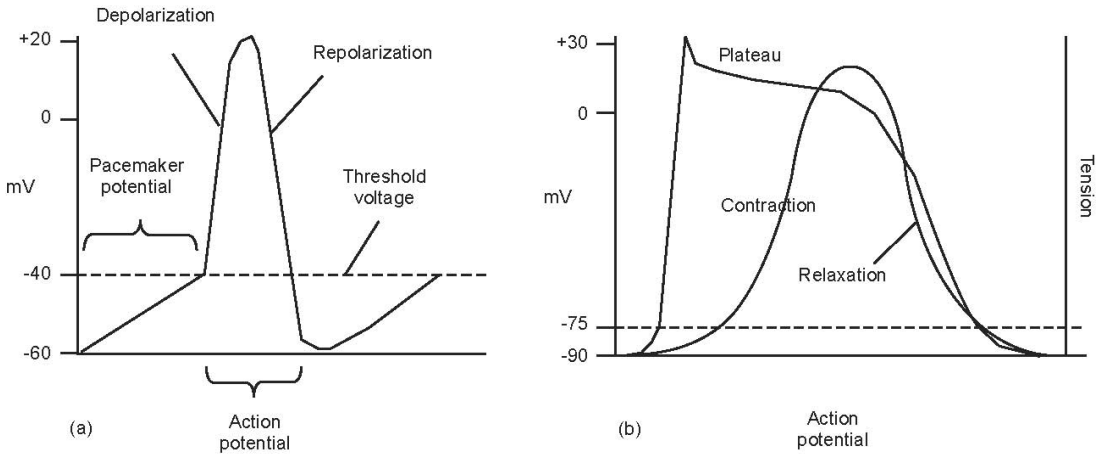


Figure 4-7. Electrical and mechanical events in heart cells. (a) Pacemaker cell (b) Ventricular contractile

Contractile Cells: Rapid depolarization due to Na^+ inflow A plateau phase due to Ca^{2+} inflow Repolarization due to K^+ outflow Refractory period during the action potential is about as long as the contraction period Allows cells time to relax before they can experience another AP

Action Potentials & Contractile Cells: Some of the Ca2+ ions from pacemaker cells diffuses into the cardiac contractile cells and causes depolarization. When threshold is reached, fast voltage-gated Na+ channels open and an action potential occurs. To repolarize the contractile cells, voltage-gated K+ channels open; however, slow voltage-gated Ca2+ channels also open which results in the temporary plateau phase when the cell very slowly repolarizes.

https://quizlet.com/296249389/cardiac-cycle-diagram/

Cardiac Conduction System

SA node → internodal pathway → AV node → AV bundle/Bundle of HIS → Bundle Branches → Purkinje fibers

The cardiac conduction system is the pathway of action potentials in the heart that result in the contraction of the heart.

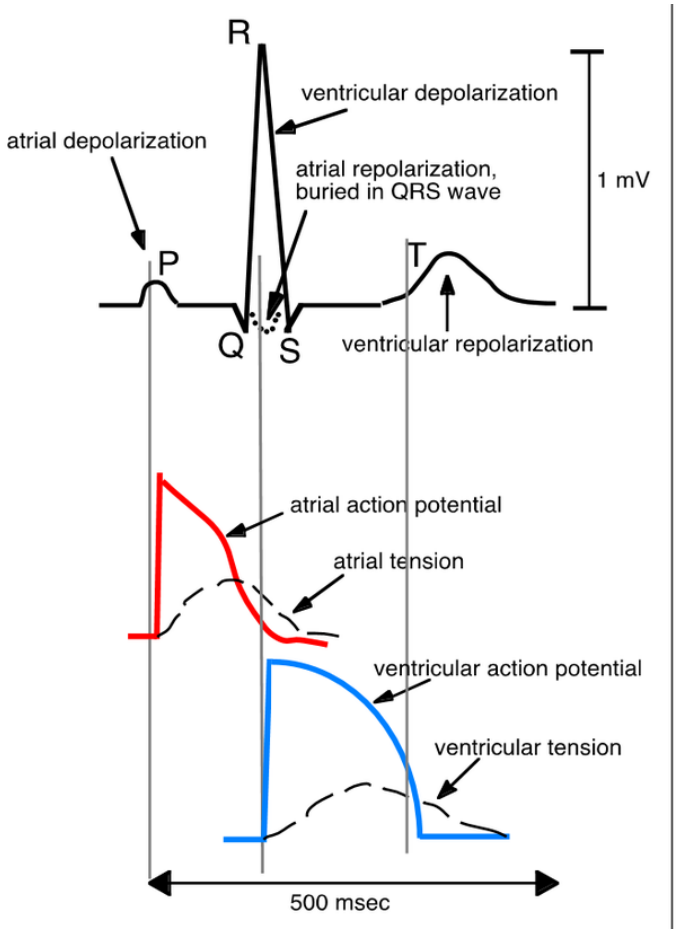
EKG & Action Potentials

Last week we looked at the basic components of the EKG, now we are going to add our knowledge of the EKG and the cardiac conduction system together.

P wave: represents pacemaker cell depolarization

QRS complex: represents contractile cell depolarization.

T wave: contractile cell repolarization.



Cardiac Cycle

The cardiac cycle represents all mechanical events from one heartbeat to the next, and it includes four major periods related to pressure and volume changes

1. Ventricular Filling

- Most atrial blood (80%) enters ventricles passively
- Atrial systole pushes remaining 20% into ventricles
- **End-diastolic volume (EDV)** is amount of blood in ventricles at the end of ventricular diastole

2. Isovolumetric Contraction

- Ventricles are contracting but there is no blood flow out of the heart
- Ventricular pressure increases until finally blood forces open the semilunar valves

3. Ventricular ejection

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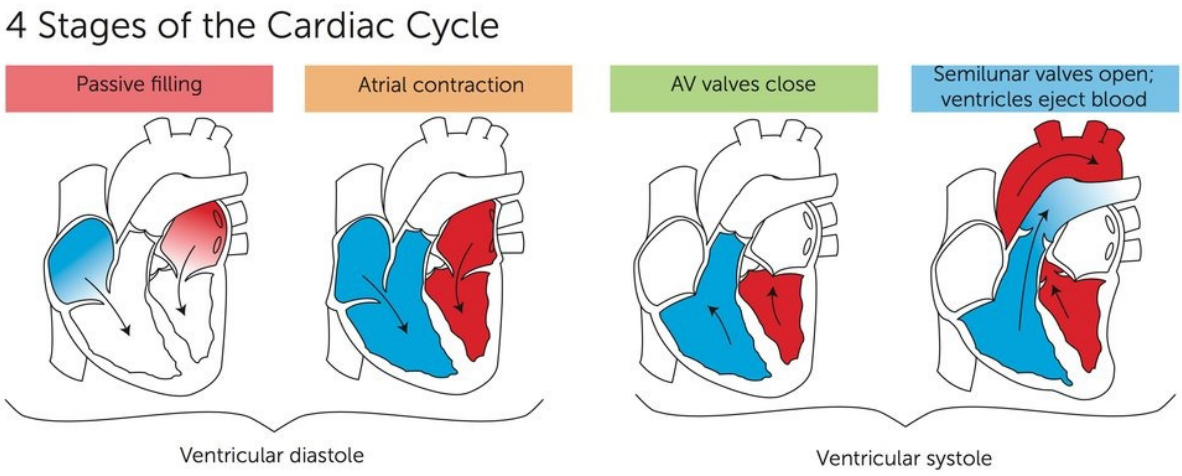

- Contracting right ventricle forces blood into pulmonary trunk
- Contracting left ventricle forces blood into aorta

4. Isovolumetric Relaxation

- Ventricles begin diastole but all heart valves are closed; no blood enters ventricles
- As ventricles expand, their chamber pressure decreases
- Higher atrial pressure forces open the AV valves