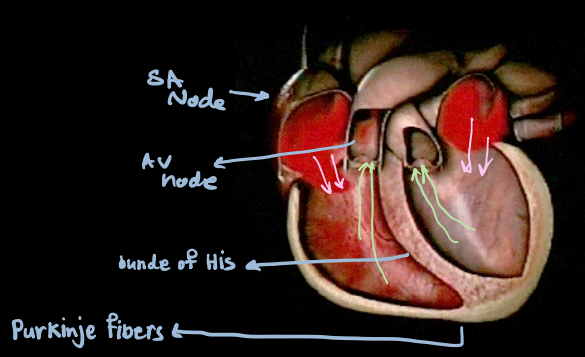
Action Potential

1. SA Node (Sinoatrial Node):
   - where the Cardiac excitation begins (الإثارة) تنتشر السبعة في الأذينين SA
   - The SA node Propagates throughout both atria
   - then the two atria Contract at the same time
   - then the AP reach to Av node
2. AV node (atrioventricular node):
   - At the Av node the AP slows as a results of various differences in cell structer in the AV node.
   - This delay Provides time for the atria to empty their bloods into the ventricles.
   - from the Av node, the AP enters The bundle of His
3. The bundle of His:
   - from the Av node, the AP enters both the right and left bundle branches
4. Purkinje Fibers:
   - rapidly Conduct the AP to the Ventricular myocardium → (Ventricular muscle fibers)
   - then the Ventricles Contract



AP occurs in Contractile fiber.

rapid Depolarization يسبب

① Depolarization:

- Contractile fibers have a stable resting membrane Potential Clost to -90 mv
- When a contractile fibers is brought to threshold by AP from neboring fibers:
  - it Voltage-gated fast Na^+ channels open allowing Na^+ inflow
  - inflow of Na^+ Produces a rapid depolarization within a few milliseconds
  - the Na^+ Channels automatically inactivate and Na^+ inflow decrease

$Na \uparrow\uparrow$ in

② Plateau:

- The Plateau: a Period of maintained depolarization

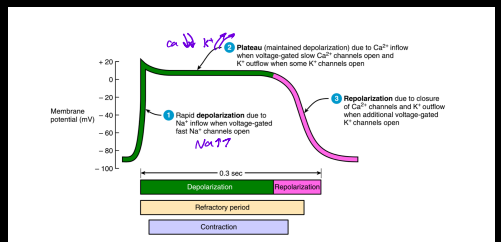
It is due to opening of Voltage-gated Slow Ca^{2+} channles (Ca^{2+} ions move from the interstitial fluid (السائل الخلالي) (which has a higher Ca^{2+} concentration) into cytosol

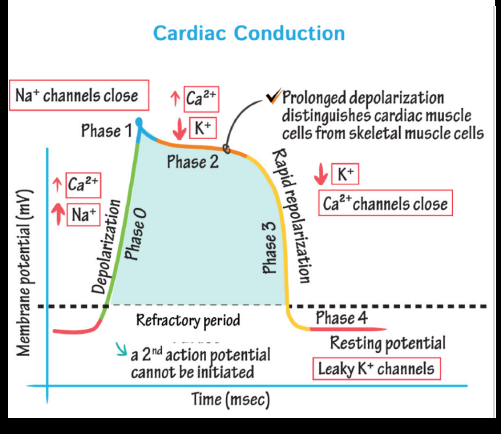
- The increased Ca^{2+} concentration inside (mainly) ultimately triggers Contraction

$\uparrow\uparrow Ca$ in → الانقباض يسبب Contraction

③ Repolarization:

- The recovery of the resting membrane Potential during the repolarization Phase of a Cardiac action Potential that in other (سريعة الإثارة) excitable cells
- After a delay (which is Particulary Prolonged in Cardic musde) additioned Voltage-gated K^+ channels open.
- outflow of K^+ restores (يعيد) the negative resting membrane potential [-90 mv]
- At the same time, the Ca^{2+} channles in the Sarcolemma and the Sarcoplasmic reticulum are Closing, which also Contriuntes (يساهم) to repolarization





<< The Cardiac cycle >>

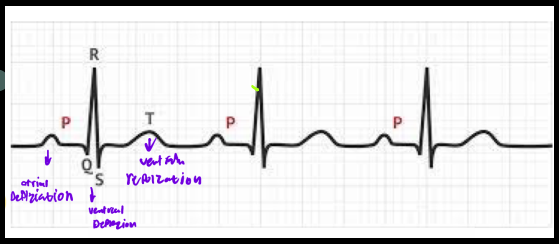
The Cardiac Cycle

- A single cardiac cycle includes all of the events associated with one heartbeat. Thus, a cardiac cycle consists of systole and diastole of the atria plus systole and diastole of the ventricles.
- The term systole refers to the phase of contraction; the phase of relaxation is diastole.

Ventricular and atria diastole
Ventricular and atria systole

Systole → contraction

Diastole → relaxation



■ Atrial systol ♥ :

Arias depolarization

1- Depolarization of SA node causes atrial depolarization [P wave]

2- atrial depolarization cuses atrial systol

Depolarization of SA node → atrial depolarization → atrial systol

3- As the atria contract, they exert Pressure on the blood within, which forces blood into the ventricles

4- Atrial systole contributes a final 25 ml of blood to the volume already in each ventricle (about 105 mL)

So each ventride Contains about 130 ml at the end of its relaxation Period [diastole] This blood volum is Called the end-diastolic volum (EDV)

Ventricular depolarization

5- The QRS Complex in the ECG makes the onset of Ventricular depolarization. [Ventricular systole]

■ Ventricular systole :

- During ventricular systole, the ventricles are Contracting and the atria are relaxed.

1- As ventricular systole begins, Pressure rises inside the ventricles and causes the AV valves to close

2- Continued Contraction of the ventricles causes Pressure inside the chambers to rise sharply

when ventricular Pressure surpasses aortic and Pulmonary artery Pressure [semi Lu nar], both SL valves open ejection of blood from the heart begins. Both Ventricles Ejects about 70 ml of per beat.

-The volume remaining in each ventricle at the end of systole about 60 ml

Ventricular repolarization

3- The T wave in the ECG marks the onset Ventricular repolarization

■ Relaxation Period : ← Distole

عشان ترتاح عضله القلب
وما يتعب ياخذ وقت راحه

* من 60 إلى 105 كيف؟
في مرحلة الراحة العضلة بتضخ بشكل
بشكل جزئي والدم يتسرب لهم ويزيد