Physio 3

Doctor 2020   -   wateen   -   medicine -   MU
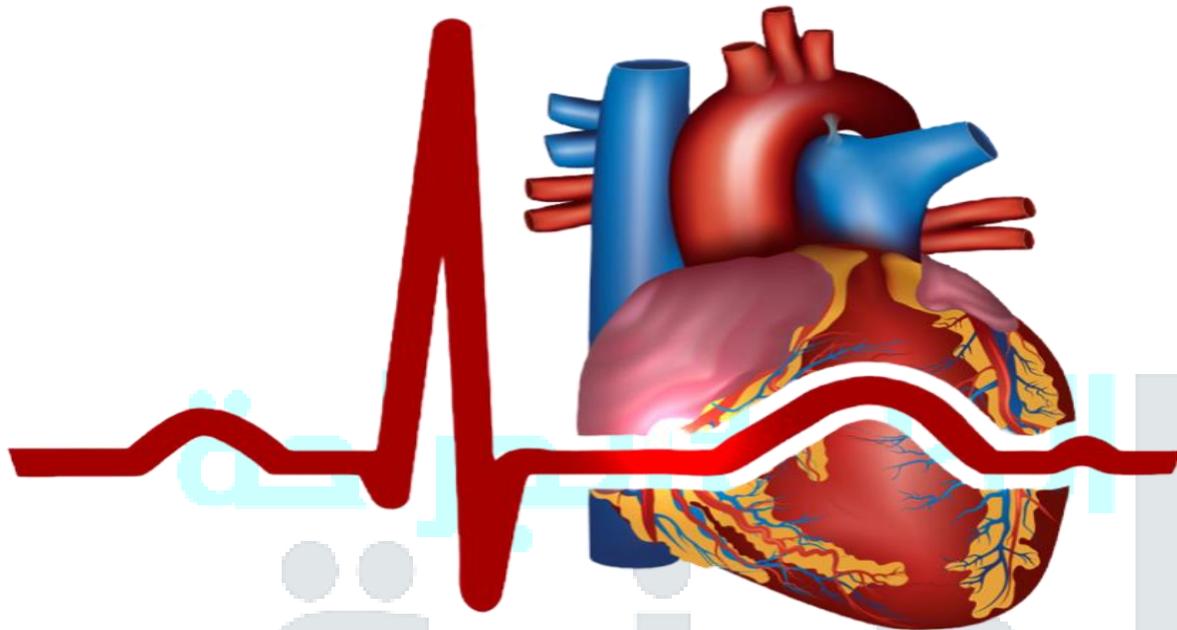
physiology sheet

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Doctor :

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Pumping action the heart

Amazing AV

- Located <u>sub</u>endocardially inferomedially region of the right atrium
- At the top of Koch region (**in right atrium**)

Deep

depression
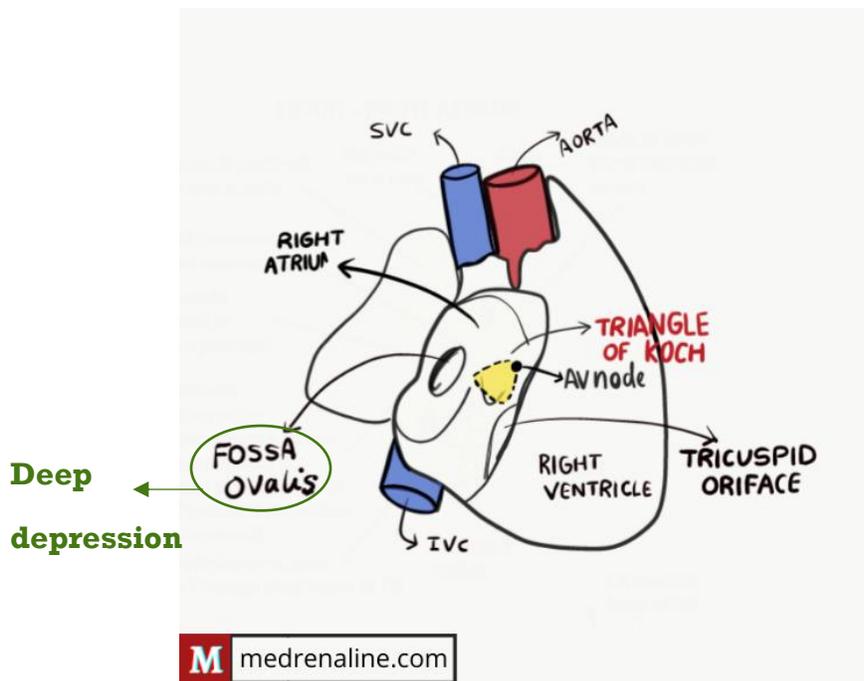
- external : Upper part SA node (**as champion → first one which take the electrical signals**) sulcus terminals (superior and inferior)
- Internal: crista terminalis

- <u>**Boundaries of the right atrium**</u> :
  - <u>**Posterior:**</u> sinus venarum (smooth)
  - <u>**triangular Koch boundaries**</u>
  - <u>**Infront of**</u> : Base of septal leaflet of tricuspid valve → **on right side**
  - <u>**behind**</u> anterior margin of opening of coronary sinus
  - <u>**above**</u> tendon of Todaro (**in fibrous skeleton of the heart, developed in adult life from eustachian tube – in fetal heart -)** → **on left side**
  - <u>**Anterior**</u> : atrium proper (rough)

Traffic cope

- **Atrial internodal pathway dumps electrical signals into fast tract**

80% fast tract only

20% fast and slow tract (supraventricular tachycardia)

➔ **Physiological:**
  Decremental conduction (slow down the action potential)
  it takes 0.1 seconds ?
  - **Two microscopic reasons for this: its structure suitable to its function**

1. **Fewer gap junction**
   What is the main function of gap junction ?
   ➔ is to send electrical signal from nodal to contractile ➔ fast simultaneously
   So that , FEWER gap junction ; like AV node ➔ slow the stimulation

2. **Smaller diameter smaller velocity**

➔ **Pathological condition:**
  overstimulation (atrial fibrillation) -heart arrythmia- Big trouble for those has Atrial fibrillation and AV node is not working (no chambers coordination)

- **Parasympathetic stimulation increase the decremental conduction and decrease heart speed**

- **Sympathetic stimulation decrease the decremental conduction and speed up the heart**

Bundel of his

• **Four** valvular ostia (for four orifice of heart) together with their fibrous ring united with very dense connective tissue

- **Aortic and two AV   right triangle**
  AV ring is connected to aortic ring

- **Aortic and mitral   left triangle**
  Aortic ring is connected to mitral ring

- **Pulmonary and aortic conus tendon**
  Pulmonary ring is connected to aortic ring

Bundle of His surrounds these four valve

Pulmonary ring

Aortic ring

Two atrioventricular (AV) rings : tricuspid and bicuspid (mitral)
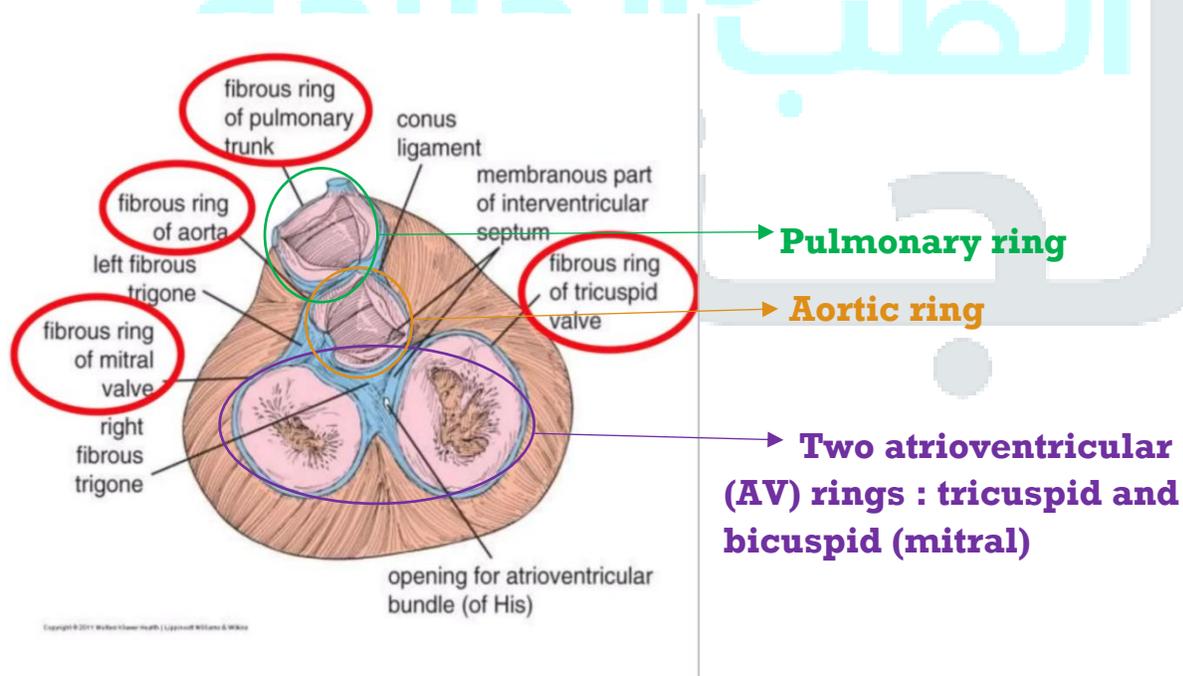
Fibrous skeleton has one hole → His (to allow passageway)

If there is more than one hole → pathologic

• **Atrioventricular bundle, AV bundle, Common bundle** penetrating fibers arise from the distal portion of the AV node

 • **Only normal physiological passageway through the fibrous skeleton**

• **More than one-hole pathological supraventricular tachycardia**

• **Has a dual blood supply important in heart attack**

➜ **Purkinje cells , limited myocardial cells**
- **Has two component**
1- **Penetrating portion**
2- **Distal portion**
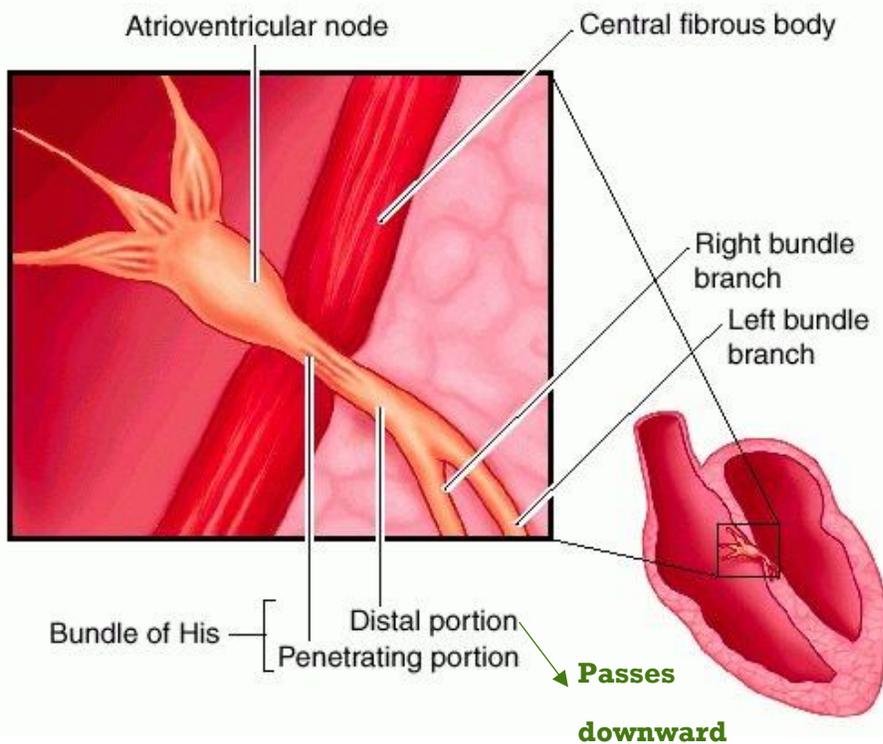
• **"hand Off" from the AV relays to the bundle branches**

Wolf Parkinson-white syndrome

• **Normal heartbeat with wolf Parkinson white syndrome**

• **Racetrack current 200 b/m**

 (atrioventricular reentry tachycardia)

between atria and ventricles
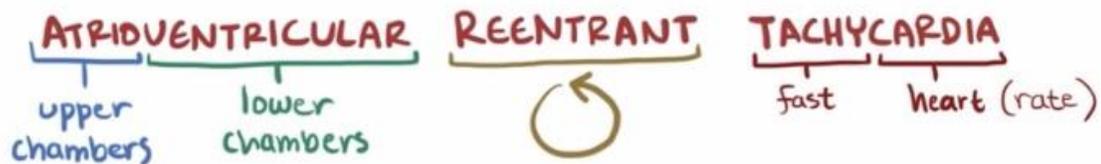
No decrementing → cause of kent fibers which stimulate the SA node as result of backup pathway تتصادم مع بعضها البعض → fast heart rate
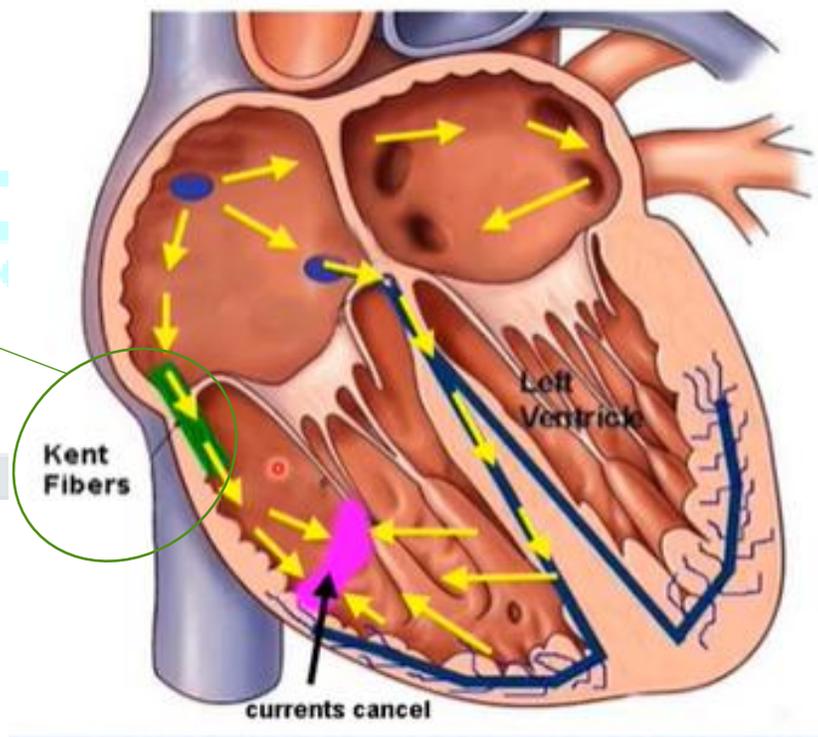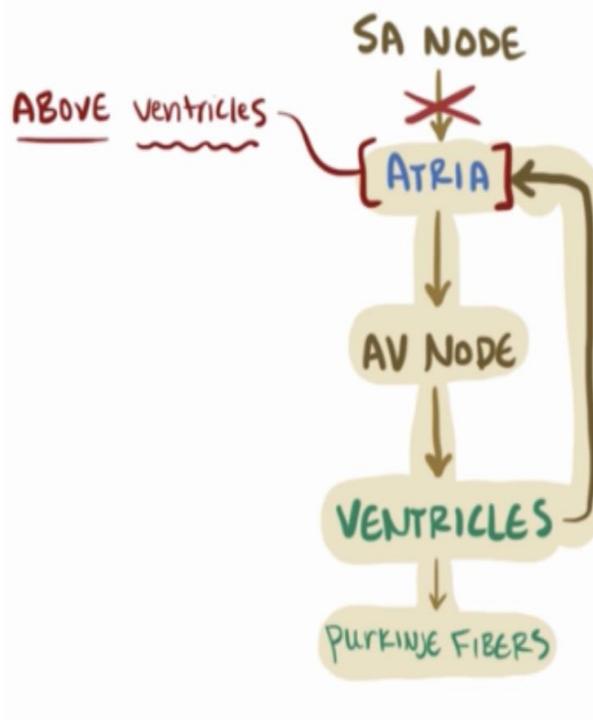

<u>Bundel branches</u>

Very deep in the endocardium

 • **Right ang left**

 • **buried deep endocardial in interventricular septum**

 • **Behaves a single branch not like the left one has three branches**

Depolarization and repolarization of nodal cells

depolarization

repolarization

Self-Induced action potential

Threshold potential

Slow depolarization (pacemaker potential)

Time (msec)

KEY
- **f** = Funny channels
- **T** = Transient-type channels
- **L** = Long-lasting channels
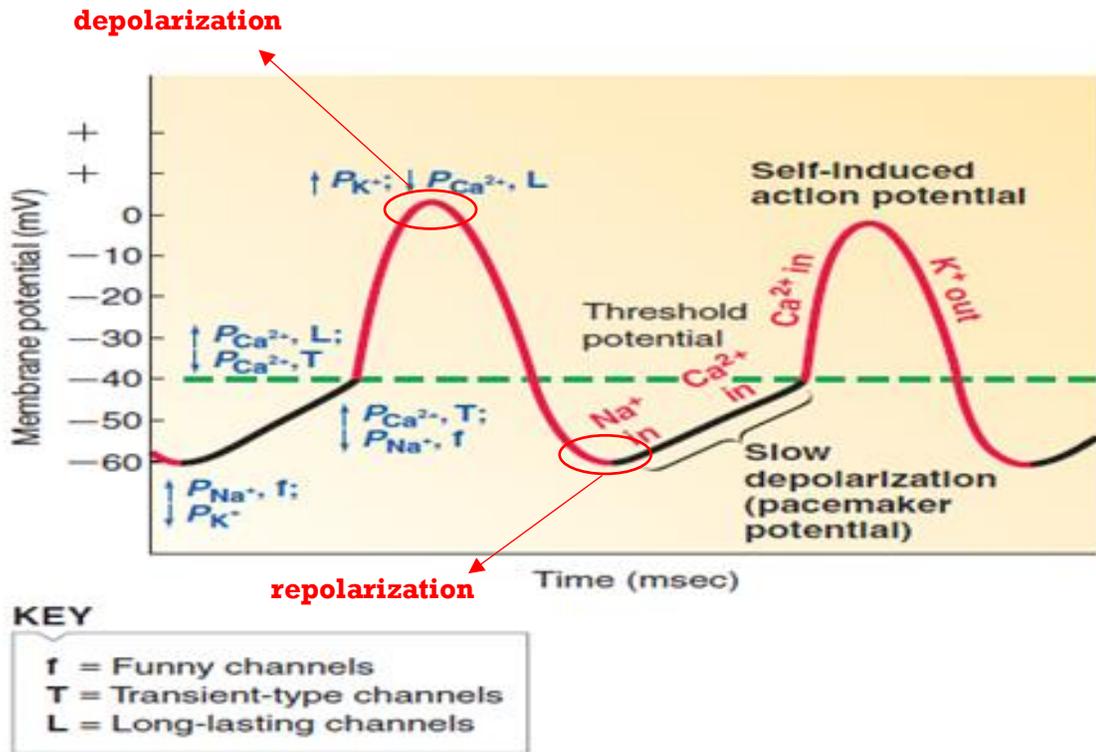
How action potential occurs in cardiac muscle ??

There is action potential for nodal cells and action potential for contractile cells

- Nodal cells has no membrane potential (not true) always fluctuating & not fixed cause of Na channels
  فمثلًا إذا بدأنا برقم عشوائي 60- → Na channels will open →
  → till reach -40 (threshold) → increase positivity
  (transient channel) Ca channels open → long lasting
  channels open → zero → depolarization → open K
  channels → repolarization

# Depolarization and Repolarization of contractile cells
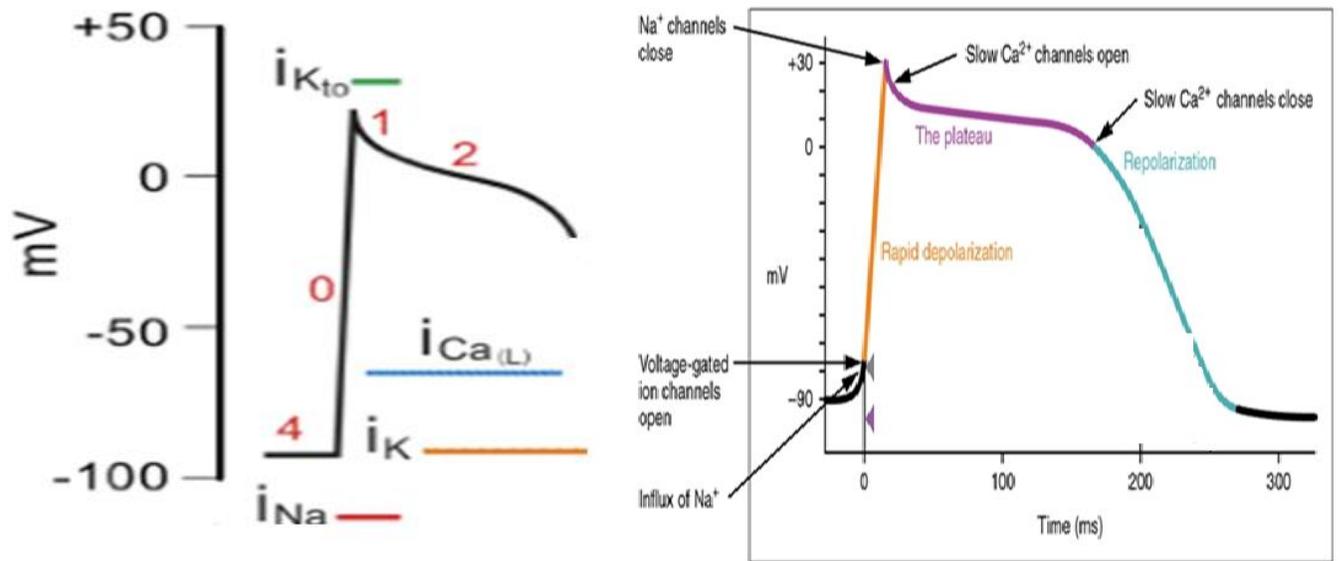
Na channels open (voltage gated ion channels) → dramatic changes in membrane potential → sudden flow which increase positivity → Ca open → little decreasing (plateau) to delay time of blood flow الطبيعي الوضع ع يأثر ما حتى و → Ca channels close → just K channels now responsible for the flow برّا الشحنة عن المسؤول و

functional syncytium

• Desmosomes is basically acting like adhesion and tighten molecules (protein)

• Intercalated disks are basically a bunch of gap junctions and desmosomes connecting the actual cardiac cells together

When muscle contract →

Increase in lengh of muscle →

Increase space between cells

→delay in electrical conduction

SO , we have desmosomes to

Prevent any change in space

between cells .