Properties of Cardiac muscle (Part 2)

Properties of the cardiac muscle:

I. Excitability

II. Rhythmicity

III. Conductivity

IV. Contractility

Disorders of conduction and spread of impulse

WPW (Wolf-Parkinson-White) syndrome

Ectopic pacemakers

Extrasystole and compensatory pause

Disorders of conduction and spread of impulse

Stannius ligatures in amphibian heart

First ligature

Second ligature

Disorders of conduction and spread of impulse

A- V blockage

Ventricular escape

Stoke Adam Syndrome

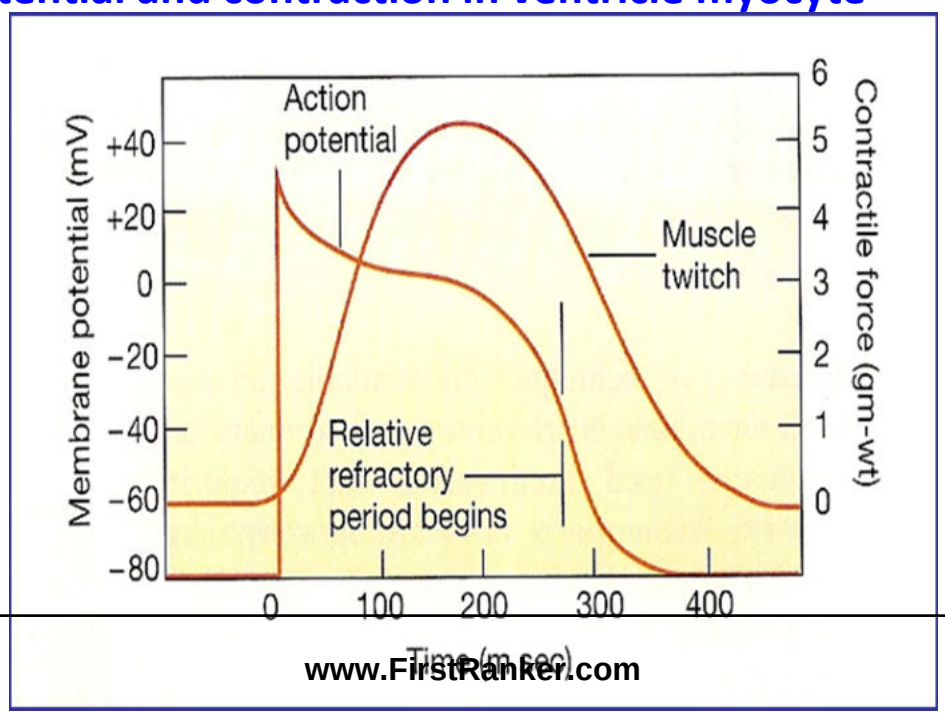
Contractility

Action potential → Increase in intracellular calcium → Contraction

Excitation-contraction coupling

Atrial and ventricular myocytes can contract while pacemaker and conducting system do not

Action potential and contraction in ventricle myocyte



Excitation-Contraction Coupling

Mechanism by which AP causes myofibrils to contract

AP passes over cardiac ms membrane

↓

AP spread to interior of cardiac ms along T tubules

↓

opening of Ca^{2+} channels in sarcolema

↓

Ca^{2+} diffuses down gradient into cell through T tubules

↓

Opening of Ca^{2+}-release channels in SR

↓

Ca^{2+} binds to troponin & stimulates contraction

Excitation-Contraction Coupling

During Repolarization

At the end of plateau of cardiac AP

↓

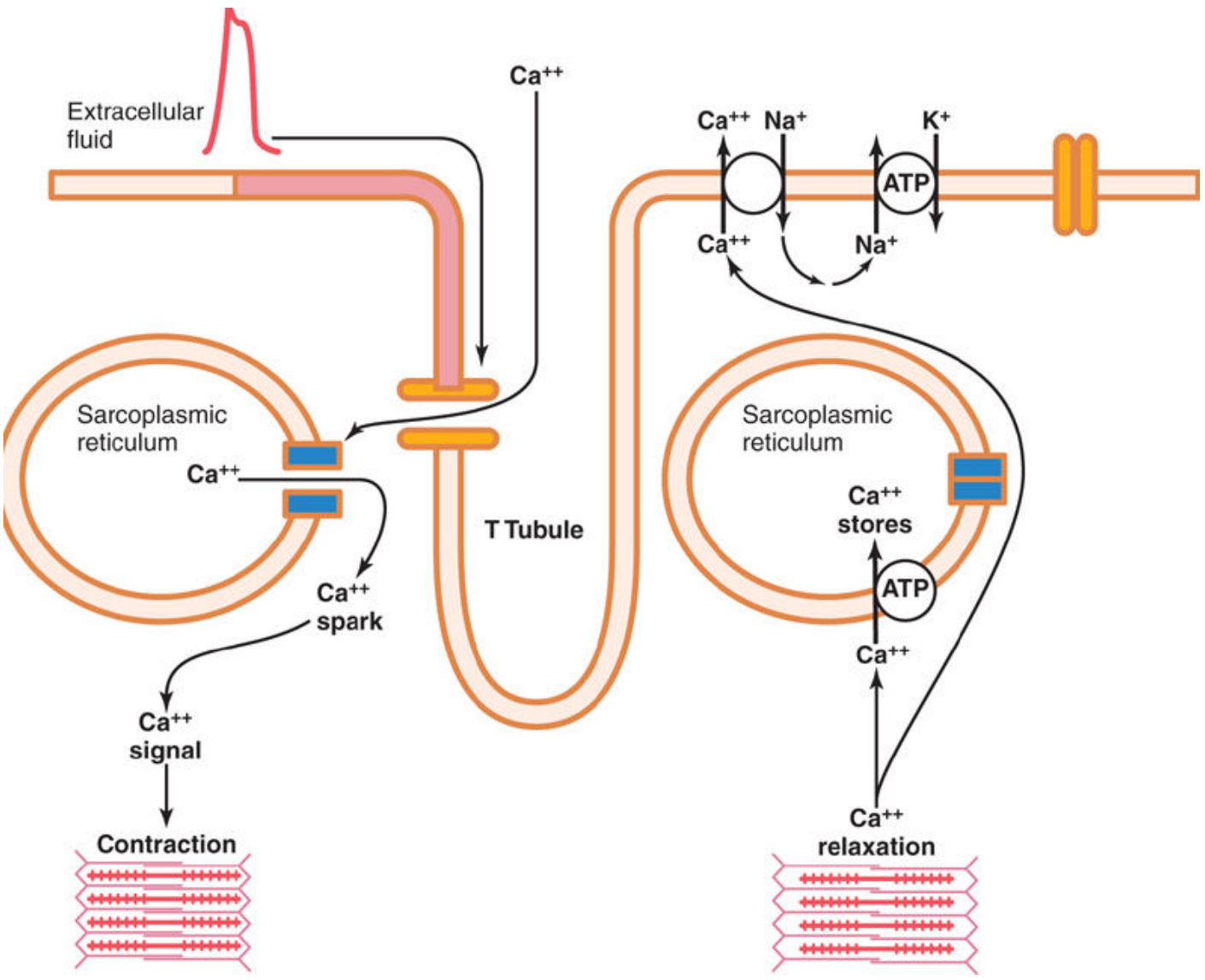
Ca^{2+} is rapidly & actively pumped out

via a Na^{+}- Ca^{2+}- exchanger

↓

Cessation of the contraction

Excitation-Contraction Coupling and Relaxation of Cardiac Muscle



Factors affecting myocardium

1. Cardiac innervation
2. Effect of ions concentration in ECF
3. Physical factors
4. Blood flow
5. Chemical factors (drugs)

- Chronotropic
- Ionotropic
- Bathmotropic
- Dromotropic

Factors affecting myocardium

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Factors affecting myocardium

6. Mechanical factors:
   a. All or none law
   b. Staircase phenomenon
   c. Starling's law of the heart

Starling's law of the heart

- "Length-tension relationship"

  'Within limits, the greater the initial length of the fiber, the stronger will be the force of its contraction; However, overstretching the fiber as in heart failure its power of contractility decreases'

  i.e. within limits, the power of contraction is directly proportional to the initial length of the ms

- Cardiac ms accommodates itself (up to certain limit) to the changes in venous return

Pressure-volume loop