PROPERTIES OF CARDIAC MUSCLE

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1. EXCITABILITY

- The heart has the ability to respond to stimuli which may be mechanical, electrical or chemical.
- This enables the heart to respond to an artificial pacemaker.
2. AUTOMATICITY

It is defined as the ability of the cell to undergo depolarization spontaneously causing the production of a nerve impulse. Automaticity is the property of a few cardiac cells only, which are also called the PACEMAKER cells of the heart.

Best example: - SA node cells
- AV nodal cells
3. RHYTHMICITY

It means that the spontaneous depolarization occurs at regular intervals, i.e. in a rhythmic manner.

Rhythmicity is present in all tissues of the heart.

The terms, automaticity & rhythmicity, are collectively called AUTO-RHYTHMICITY.
4. CONDUCTIVITY

It is the ability of the muscle to propagate an impulse.

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All heart muscles can conduct the impulses, however, the conduction system of the heart comprises the following:

• AV node
• Bundle of HIS
• Lt. & Rt. Bundle Branches
• Purkinje Fibers

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Impulses are conducted in one direction only.
5. CONTRACTILITY

This means that the myocardial fibers can undergo shortening OR contraction.

**FACTORS INCREASING CONTRACTILITY**

- Catecholamines & their agonists.
- Calcium ions
- Digitalis

**FACTORS DECREASING CONTRACTILITY**

- Acetylcholine
- Drugs that block beta receptors.
- Drugs that block calcium channels
- Potassium ions
- Excess CO$_2$ (Hypercapnia)
- Acidosis
6. REFRACTORY PERIOD

It is the time period when the heart fibers will not contract in response to a stimulus whatever its strength may be.

- Absolute Refractory period
- Relative Refractory period
- Cause---------?
- Advantage---------? Why does the Heart need to relax in between contractions?
- What is tetanization and why does it not occur in cardiac muscle?
**FIGURE 9-17**

Relationship of an action potential and the refractory period to the duration of the contractile response in cardiac muscle.
7. ALL OR NONE LAW

Heart is a functional syncytium, therefore, all its fibers act as a single fiber. Thus, the heart muscle as a whole obeys the All or None law.

On being given a stimulus, either the heart contracts with complete force or it does not contract.
7. FRANK-STARLING’S LAW

Volume of blood ejected by the ventricle depends on the volume present in the ventricle at the end of the diastole. (Higher the initial length of the cardiac muscle fibers, just before the start of the contraction, more forceful will be their contraction.)
More blood goes into the heart, more blood is pumped out of the heart (within normal limits).

Increased filling pressure stretches the heart and increases its force of contraction. Increasing the force of contraction expels more blood from the left ventricle, so that cardiac output increases when the preload increases. (Preload is Rt. Atrial Pressure)

It is the Frank-Starling mechanism that maintains a precise balance between the outputs of the RIGHT & LEFT ventricles.

**Frank Starling Law of the Heart**

Increased blood volume = increased stretch of myocardium

Increased force to pump blood out.