

# Homeometric regulation of the heart

## Characteristics

- the ability to change the force of contraction of the cardiac muscle even with a constant length of cardiomyocytes
- does not depend on changes in sarcomere length
- affects inotropy (contractility)
- in contrast to heterometric control, more beats are required for the regulation to take effect
- the goal is to change cardiac output

## Means of homeometric control

### Sympathetic

- Positively chronotropic, inotropic, dromotropic and batmotropic effect

### Parasympathetic

- Negatively chronotropic, inotropic, dromotropic and batmotropic effect

## Potassium cations

- At elevated extracellular concentrations, there is a slow depolarization of the resting membrane potential (values closer to zero) and a concomitant inactivation of some sodium channels (thus preventing the action potential), <sup>[1]</sup>, net effect is:
  - the intensity of the action potential is reduced
  - heart dilated, flaccid
  - heart rate slows down
  - in severe hyperkalaemia -up to blockage of impulse transmission through the atrioventricular bundle

## Calcium cations

- opposite effect to potassium cations
- increased concentration gradually leads to spastic contraction (calcium cations initiate contraction)
- at **reduced concentration** - flaccidity

## Bowditch (Treppe) effect

- see Bowditch effect

## Temperature

- heat increases the permeability of the membrane to ions
- **frequency**
  - Increased temperature significantly increases frequency
  - reduced temperature significantly decreases frequency
  - in near-death hypothermia (15-20 °C) frequency only a few beats per minute
- frequency only a few beats per minute
- **force of contraction**
  - temporarily strengthened when the temperature rises, then the metabolic system is exhausted and the contraction is weakened

## Links

## Related articles

- Frank-Starling mechanism (heterometric regulation of the heart)

## References

1. <https://en.wikipedia.org/wiki/Hyperkalemia#Pathophysiology>

## Used literature

- GUYTON, Arthur C. – HALL, John E. *Textbook of Medical Physiology*. 11. edition. Elsevier, 2006. ISBN 978-0-7216-0240-0.