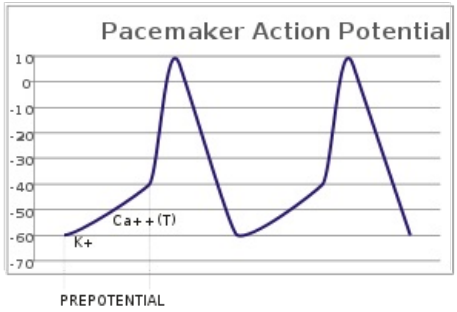
Pacemaker potential

Pacemaker is a term for cells that spontaneously generate an action potential. This property is called **autorhythmicity**. Typically, pacemaker cells are used in by the cardiac conduction system, where they create the heart rhythm.

Spontaneous diastolic depolarization

In cells of the sinoatrial and atrioventricular node **does not occur** resting membrane potential. Instead of him to everyone the action potential is preceded by a gradual change in the membrane potential towards the threshold value. This event is called **spontaneous diastolic depolarization** and depends on the autonomic nervous system.



Pacemaker Potential

The essence of the action is the movements of the following ions:

- **Na^+** intracellularly
- **Ca^{2+}** intracellularly
- reduced current of **K^+** extracellularly

Na^+ ions enter the cell through *funny channels* and are less important in terms of overall depolarization.Ca^{2+} ions have the largest share in the occurrence of spontaneous diastolic depolarization. There is an influx of Ca^{2+} into the cell through specific channels. The influx of calcium ions causes gradual depolarization and the subsequent formation of an action potential. The last of the events mentioned is the reduction of the K^+ flow out of the cell. This gradual inactivation plays a fundamental role in the occurrence of spontaneous diastolic depolarization − under normal circumstances, the K^+ current is responsible for maintaining the resting membrane potential.

Creation of excitement

🔎 *For more information see Cardiac conduction system.*

Physiologically, the **sinoatrial (SA) node** is responsible for the generation of impulses. Of all the other parts of the conduction system, its membrane potential is closest to the threshold value, so it forms an action potential first. This node acts as a **primary (natural) pacemaker** and the rhythm it sets is called a **sinus**. Under pathological conditions, the **atrioventricular (AV) node** or some cell of the conduction system (most often the **Purkinje fibers**) takes over the pacemaker function - the pacemaker created in this way is referred to as an **ectopic pacemaker**. The rhythm generated by the AV node is called **nodal**, the Purkinje fibers generate the **idioventricular rhythm**.

Regulation of the pacemaker potential

The generation of the pacemaker potential is primarily controlled autonomic nervous system. Sympathetic causes **increased influx of Ca^{2+} and Na^+ into the cell** and at the same time **inactivates K^+ > channels** and thus prevents the efflux of ions from the cell − this leads to a faster course of spontaneous diastolic depolarization. Effect parasympathetic is exactly the opposite. Considering that the SA node generates approximately 100 excitations per minute at rest[1], the parasympathetic must predominate at a resting rate of 60-80 beats per minute.

Links

Related articles

- Heart
- Action potential in the heart
- Resting Membrane Potential
- Cardiac conduction system
- Electrocardiography

External links

- Akčný potenciál a Pacemaker (TECHmED) (https://www.techmed.sk/akcny-potencial/)
- Pacemaker potential (https://en.wikipedia.org/wiki/Pacemaker_potential)

Reference

1. KITTNAR, Otomar – ET AL.,. *Lékařská fyziologie.* 1. edition. Grada, 2011. 790 pp. pp. 201. ISBN 978-80-247-3068-4.

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- SILBERNAGL, Stefan – DESPOPOULOS, Agamemnon. *Atlas fyziologie člověka.* 6. edition. Grada, 2003. 435 pp. ISBN 80-247-0630-X.