

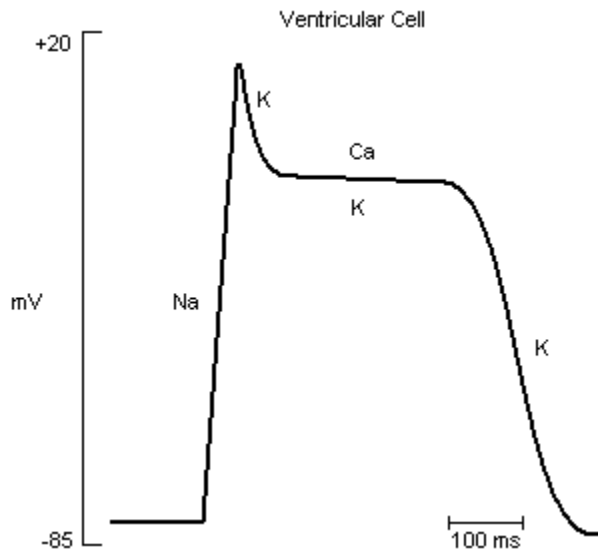
BIOEN 3202 – HUMAN PHYSIOLOGY II
LECTURE NOTES
MARCH 10TH, 2006

Compiled by
David Sutherland

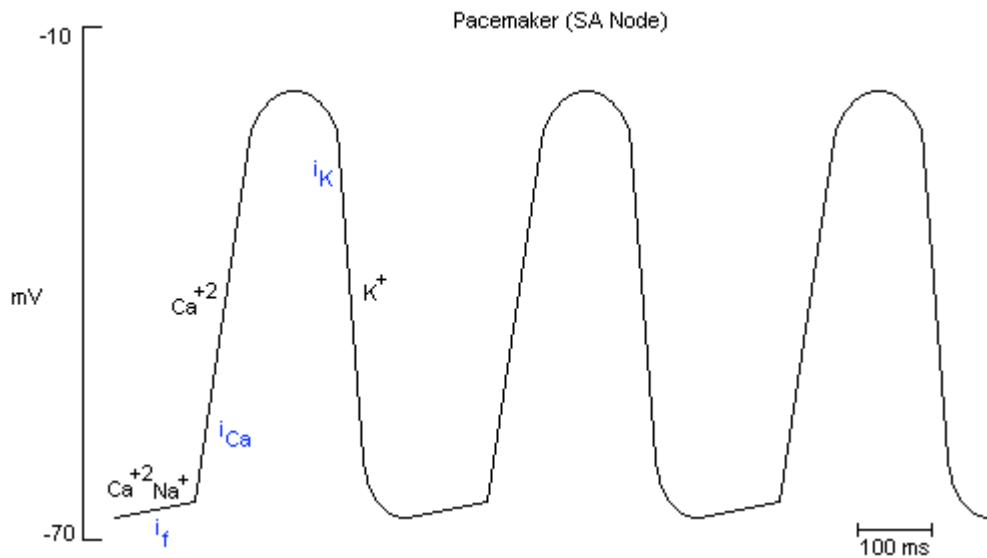
I. Action Potential Figures:

a. Ventricular Cell

- i. Rapid Na^+ influx causes depolarization
- ii. Ca^{+2} and K^+ balance currents in plateau phase
- iii. Rapid K^+ efflux causes repolarization (in 2 places); there are some 20 different potassium currents known so far.

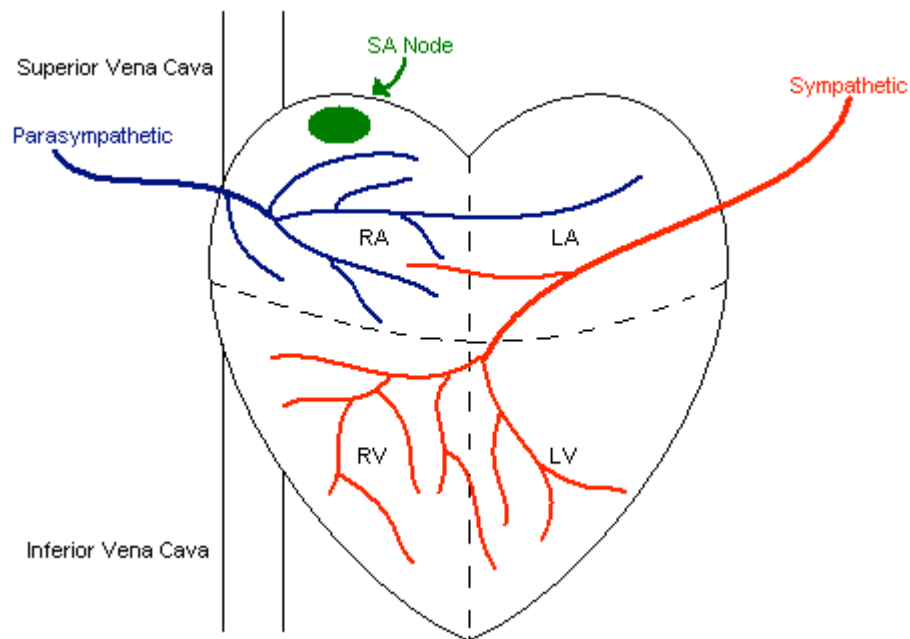


b. Pacemaker cell (Sinoatrial (SA) node)



- i. I_f = Funny Current, composite of Na^+ and Ca^{+2} flow, which leads to spontaneous depolarization until membrane reaches threshold and action potential can fire.
- c. Digression into resting potential, driving force and ionic currents
 - i. Resting Potential – determined by:
 - 1. Nernst Potential of ions
 - 2. Relative Permeability of ions ($P_K \gg P_{\text{Na}} > P_{\text{Ca}}$)
 - ii. Driving Force: ($V_m - V_i$)
 - 1. Equilibrium \Rightarrow Nernst Potential
 - iii. Ionic Current: ($i_i = (V_m - V_i)g_i$)
 - 1. A form of Ohm's Law ($V = IR$)
- d. How to change AP frequency at SA node:
 - i. \uparrow or \downarrow in Ca^{+2} conductance during rising phase results in slight change in HR (not significant)
 - ii. \uparrow or \downarrow in K^+ conductance results in \uparrow or \downarrow of resting potential and \uparrow or \downarrow in duration of repolarization.
 - 1. Only \uparrow in K^+ is significant; decelerates HR using parasympathetic neurotransmitter, acetylcholine (ACh).
 - iii. \uparrow or \downarrow in size of i_f results in \uparrow or \downarrow of slope of threshold phase which leads to shortening or lengthening of that phase and subsequent change in HR.
 - 1. \uparrow in i_f is only significant here; it accelerates the HR using the sympathetic neurotransmitter, norepinephrine (NE).

II. ANS Innervation



- a. HR also regulated by endocrine system
 - i. Slower to act than ANS
 - ii. Primary means of HR control in transplant recipients
 - iii. Non-specific, i.e., neurotransmitters are in the blood and hence everywhere in the body. ANS control is much more targeted.

- III. Vocabulary
 - a. Pacemaker
 - b. Sinoatrial (SA) Node