

Compact Computer Model of Rabbit Atrioventricular Node with Autonomic Nervous System Control

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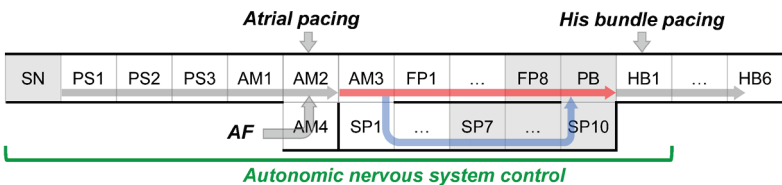
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Transmitting signals from the atria to the ventricles, the atrioventricular (AV) node plays a vital role in synchronizing atrial and ventricular contractions by providing conduction delay and protecting the ventricles from atrial arrhythmias. The electrophysiological processes inside the AV node are not completely clear, and their study through experiments is rather difficult. On the other hand, there are very few computer models of the AV node.

We present a compact multifunctional computer model of the rabbit AV node. The model is based on the Aliev-Panfilov cardiac cell model and its pacemaking variant and includes a simplified sinoatrial node, dual (fast and slow) pathway AV node structure, AV nodal pacemaker, and proximal His bundle. The model closely reproduces experimentally obtained anterograde and retrograde conduction curves and allows visualization of fast and slow pathway conduction in the form of ladder diagrams, providing deeper insight into the pathways interaction.

In addition to the previous version, the model presented here incorporates a novel element - the effect of the autonomic nervous system. The combined effect of sympathetic and parasympathetic tones on AV nodal conduction manifests in changes in atrial-His bundle conduction time and regular sinus rhythm, the onset and spontaneous termination of atrioventricular nodal reentrant tachycardia (AVNRT), and changes in filtering function in atrial fibrillation (AF).

The model represents a valuable tool for studying the AV node and opens new possibilities for studying and understanding cardiac electrophysiology.



Scheme of the rabbit AV node model. SN - sinus node, PS - peripheral sinus node, AM - atrial muscle, FP - fast pathway, SP - slow pathway, PB - penetrating bundle, and HB - His bundle cells.