Preface

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Cardiac pacemaker cells are located mainly in the sino-atrial (SA) node and drive highly constant heartbeats mediated via an excitation conduction system. The isolated SA nodal cells display a different spindle-shape compared with other cardiac muscle cells, but are still spontaneously contractile. A number of different ionic channel currents are involved in the generation of pacemaker activity by these cells, such as both L- and T-type Ca\(^{2+}\) currents, the delayed rectifier K\(^+\) current, the sustained inward current, and the hyperpolarization-activated inward current. However, it has recently been shown that the ionic channel mechanisms for pacemaker activity are somewhat different between various species such as rats, pigs and monkeys. While the pacemaker cells beat spontaneously, their activity is strongly regulated by the autonomic nervous system by way of both sympathetic and vagal parasympathetic nerves. Nevertheless, arrhythmias can be caused as a result of a number of factors, including autonomic dysfunction.

On the other hand, different pacemaker cell networks appear to drive spontaneous motility in the gut of various animal species. Although the spontaneous motility is not as regular as that in the heartbeat, the interstitial cells of Cajal (ICC) which provide this pacemaker activity are spontaneously active. In contrast to cardiac pacemaker cells, the ICC pacemaker networks are different in particular regions of the gut, such as the stomach, small intestine and large intestine and also between different species such as mice, rats and dogs. The ICC network is widely distributed within submucosal (ICC-SM), intramuscular (ICC-IM, ICC-DMP) and inter-muscular layers (ICC-MY). And again, there are a number of different ionic channel currents involved in the generation of the pacemaker activity, such as the Ca\(^{2+}\)-dependent K\(^+\) current, the Ca\(^{2+}\)-dependent Cl\(^-\) current, both L- and T-type Ca\(^{2+}\) currents, and the non-selective cationic channel current. The activity of these pacemaker cells in the gut is also controlled by the autonomic nervous system via the splanchnic, lumbar colonic and hypogastric nerves, as well as the vagal and pelvic nerves and/or the submucosal and myenteric plexuses of the enteric nervous system. In the following review papers we will elucidate the differences and similarities between the pacemaker mechanisms of both the heart and the gut, and the relevance of these factors in the investigation of cardiac and gastrointestinal physiological functions and their pharmacological therapy.