Potassium channels are key determinants of arterial smooth muscle contractility. The most recent addition to the potassium channel pantheon in arterial smooth muscle are the Kv7 channels encoded by the KCNQ genes (KCNQ1-5). Initially identified in the mid-1990s they have been studied extensively in neurones and cardiac cells where they have a crucial role in normal physiology and mutations to KCNQ genes underlie many hereditary disorders. However, the past decade has seen an explosion of information about the expression, functional impact and regulation of these channels in smooth muscle cells. This seminar presents an overview of Kv7 channels in normal arterial dilatation and the possible mechanisms underlying their dysfunction in vascular disease.