Ryanodine receptor

Overview: The ryanodine receptors (RyRs) are found on intracellular Ca^{2+} storage/release organelles. The family of RyR genes encodes three highly related Ca^{2+} release channels: RyR1, RyR2 and RyR3, which assemble as large tetrameric structures. These RyR channels are ubiquitously expressed in many types of cells and participate in a variety of important Ca^{2+} signalling phenomena (neurotransmission, secretion, etc.). In addition to the three mammalian isoforms described below, various non-mammalian isoforms of the RyR have been identified, and these are discussed in Sutko and Airey (1996). The function of the RyR channels may also be influenced by closely associated proteins such as the tacrolimus (FK506)-binding protein, calmodulin (Yamaguchi *et al.*, 2003), triadin, calsequestrin, junctin and sorcin, and by protein kinases and phosphatases.

Nomenclature	RyR1	RyR2	RyR3
Ensembl ID	ENSG00000196218	ENSG00000198626	ENSG00000198838
Endogenous activators	Depolarization via DHP receptor, cytosolic Ca^{2+} (μM), cytosolic ATP (mM), luminal Ca^{2+}, calmodulin at low cytosolic Ca^{2+}, CaM kinase, PKA	Cytosolic Ca^{2+} (μM), cytosolic ATP (mM), luminal Ca^{2+}, CaM kinase, PKA	Cytosolic Ca^{2+} (μM), cytosolic ATP (mM), calmodulin at low cytosolic Ca^{2+}
Pharmacological activators	Ryanodine (nM–μM), caffeine (mM), suramin (μM)	Ryanodine (nM–μM), caffeine (mM), suramin (μM)	Ryanodine (nM–μM), caffeine (mM)
Antagonists	Cytosolic Ca^{2+}(>100 μM), cytosolic Mg^{2+} (mM), calmodulin at high cytosolic Ca^{2+} dantrolene	Cytosolic Ca^{2+}(>1 mM), cytosolic Mg^{2+} (mM), calmodulin at high cytosolic Ca^{2+}	Cytosolic Ca^{2+}(>1 mM), cytosolic Mg^{2+} (mM), calmodulin at high cytosolic Ca^{2+}, dantrolene
Channel blockers	Ryanodine (>100 μM), ruthenium red, procaine	Ryanodine (>100 μM), ruthenium red, procaine	Ruthenium red
Functional characteristics	Ca^{2+}: (P_{Ca}/P_K ~ 6) single-channel conductance: ~90 pS (50 mM Ca^{2+}), 770 pS (200 mM K^+)	Ca^{2+}: (P_{Ca}/P_K ~ 6) single-channel conductance: ~90 pS (50 mM Ca^{2+}), 720 pS (210 mM K^+)	Ca^{2+}: (P_{Ca}/P_K ~ 6) single-channel conductance: ~140 pS (250 mM Ca^{2+}), 777 pS (250 mM K^+)

The modulators of channel function included in this table are those most commonly used to identify ryanodine-sensitive Ca^{2+} release pathways. Numerous other modulators of RyR/channel function can be found in the reviews listed below. The absence of a modulator of a particular isoform of receptor indicates that the action of that modulator has not been determined, not that it is without effect. The potential role of cyclic ADP ribose as an endogenous regulator of RyR channels is controversial. A region of RyR likely to be involved in ion translocation and selection has been identified (Zhao *et al.*, 1999; Gao *et al.*, 2000).

Further Reading

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