Exploring short term plasticity in guinea-pig myenteric neurons

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Enteric neurons undergo long-term increases in excitability during inflammation or infection, and can change the proportion of neurotransmitters responsible for fast synaptic transmission. We hypothesised that short-term, low frequency stimulation would be associated with an upregulation of non-nicotinic fast synaptic transmission (fast EPSPs). Two methods were used to monitor membrane potential changes in myenteric neurons from the guinea pig ileum: intracellular recordings, and fast CCD-based imaging with the potentiometric dye di-8-ANEPPS. Low frequency electrical stimulation of an interganglionic strand was used to stimulate activity in the myenteric network. Hexamethonium (200μM) was used to block nicotinic fast EPSPs. Imaging experiments revealed a control fast EPSP amplitude of 1.00±0.10ΔF/F (n=50 neurons). Following addition of hexamethonium for 10 minutes the fast EPSP was reduced to 0.55±0.07ΔF/F (55% of control). A train of electrical stimuli was then applied for 5 minutes (1Hz, 0.4ms) followed by a rest period of 2.5 minutes and fast EPSPs evoked again. After the first train fast EPSPs were still depressed (49% of control) and further trains of electrical stimulation did not improve this. Washout of hexamethonium resulted in fast EPSP amplitude returning to 67% of control (n=20). Electrophysiological experiments also showed that in the presence of hexamethonium fast EPSP amplitude remained depressed after stimulation (hexamethonium : 38% of control; after stimulation: 30% of control, n=5). In the presence of nicotinic blockade low frequency electrical stimulation of mixed excitatory/inhibitory fibres was not associated with an increase in fast EPSP amplitude. We predict that selective stimulation of excitatory fibres alone may be associated with an increase in non-nicotinic fast synaptic transmission.