Integration of sensory information by multi-functional enteric neurons

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The motility of the gastrointestinal tract comprises a diverse set of behaviours which are primarily controlled by the neural circuits of the enteric nervous system (ENS). The ENS contains all functional classes of neuron required for complete reflex arcs, however, recent data suggest that many neurons play several roles and could best be thought of as multi-functional enteric neurons (MUFENs). One of the most important and intriguing kinds of MUFEN are those that respond both to sensory stimuli and synaptic input. Thus far these include mono-axonal neurons in the colon which adapt slowly to maintained stretch, another population in the ileum that adapt rapidly to stretch, and the multi-axonal AH/Dogiel type II neurons found in both the ileum and colon. The AH/Dogiel type II neurons have three outstanding features which provide a useful template for understanding the function of MUFENs. They have reciprocal slow synaptic inputs with other neurons demonstrating an interneuron role; they respond to mechanical deformation and chemical stimuli demonstrating a sensory neuron role; and they have a large after-hyperpolarising potential (AHP) at the soma which allows synapse independent shaping of sensory input. Their ability to fire APs, and hence, drive outputs, is strongly determined by the recent firing history of the neuron (through the AHP) and network activity (through slow synaptic transmission). Positive feedback within the population of AH/Dogiel type II neurons means that the network is able to drive outputs well beyond the duration of the stimuli. In general, it could be speculated that this processing of sensory information is integral to the functions of the ENS. Thus, MUFENs contribute another layer of complexity to the control of the gastrointestinal tract.