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Feedback modulation of intrinsic firing dynamics restores feature detection in electrosensory processing

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Neurons are almost invariably embedded in complex feedback networks. In order to study the feedback regulation of individual neurons and their ability to accurately code sensory information we chose to examine a simple, well understood feedback network. Specifically, we examine here a simple network based on the known neuroanatomical substrates underlying sensory processing in the weakly electric fish *Apteronotus leptorhynchus*. We consider here a network of 100 biophysically plausible model neurons, embedded in an inhibitory closed loop consisting of $GABA_A$ and $GABA_B$ mediated conductances. We have shown previously an interaction between the $GABA_B$ portion of this inhibitory feedback and the burst dynamics intrinsic to ELL pyramidal cells. By including the intrinsic bursting dynamics we are able to replicate specific *in vivo* results relating to the regulation of bursting by this feedback network, and able to examine the regulation of sensory coding by this feedback. The $GABA_A$ component of the inhibition is able to create a network mediated oscillation, which significantly deteriorates coding. The $GABA_B$ component, while unable to ameliorate the interference of the network oscillation, is able to restore the feature detection properties of the individual units such that the ability to accurately detect burst stimuli is improved. This may represent a mechanism for improving the detection of prey-like stimuli in the presence of conspecifics.