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What I_h does to a primate stress neuron

Parvocellular neurons of the paraventricular nucleus sit at the top of the hypothalamic–pituitary–adrenal axis, which is a feedback loop rather than a chain, so the gain of its first step matters. Our collaborators' recordings show a far more prominent voltage sag in marmoset parvocellular neurons than in mouse; in marmoset, blocking the hyperpolarisation-activated cyclic nucleotide-gated (HCN) current removes it.

We ask what that current does in a conductance-based model of one marmoset neuron, fitted to recordings from the same cell with and without HCN block.

In the fitted cell the current makes the membrane band-pass, and removing it abolishes the peak and raises the steady-state impedance, in the model and in the recording. The same removal turns a train of synaptic inputs that stays subthreshold into one that fires. Spike onset, however, is a saddle-node on an invariant circle with and without the current, so the cell is Class I in both conditions; the change is subthreshold.

Receptor antagonists for this axis that showed promise in rodents failed to separate from placebo in human trials and were abandoned as a class; species differences in ion channel complement are one suspected reason. A model fitted to the primate cell makes one such difference quantitative. Extending the same question to the population is the next step.