Supplementary figures

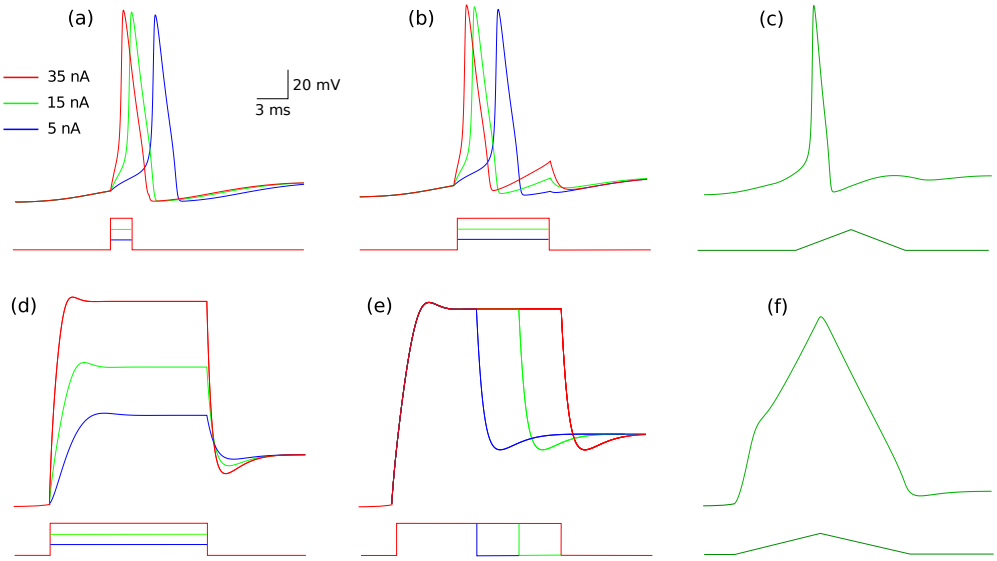

Figure S1: Difference of features between action potentials (a-c) and graded potentials (d-f). Action potentials have been simulated from the classical Hodgkin-Huxley model, while graded potentials have been obtained by reducing its maximal conductances g_{Na} and g_K. The amplitude and waveform of the action potentials are essentially invariant with respect to the (a) amplitude, (b) duration, and (c) waveform of the stimulus, while the amplitude and waveform of the graded potentials are dependent on the (d) amplitude, (e) duration, and (f) waveform of the stimulus. This figure has been reproduced from Naudin et al. (2022a) with the consent of the authors.

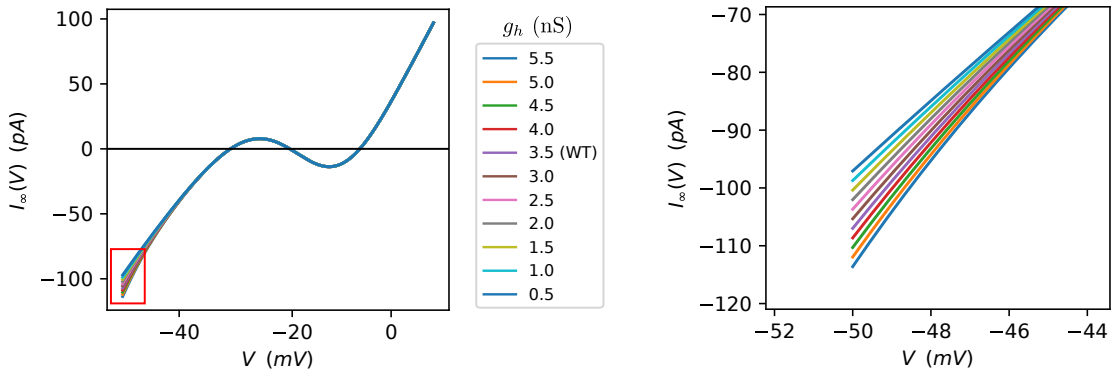

Figure S2: Evolution of the steady-state current curve as the value of the conductance g_h varies. No phenotype change is induced.

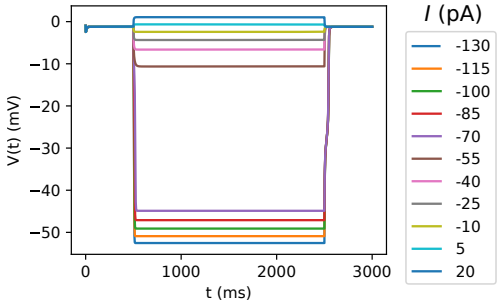

Figure S3: Example of voltage dynamics of phenotype 2*. This phenotype is characterized by a hyperpolarizing jump of the voltage.

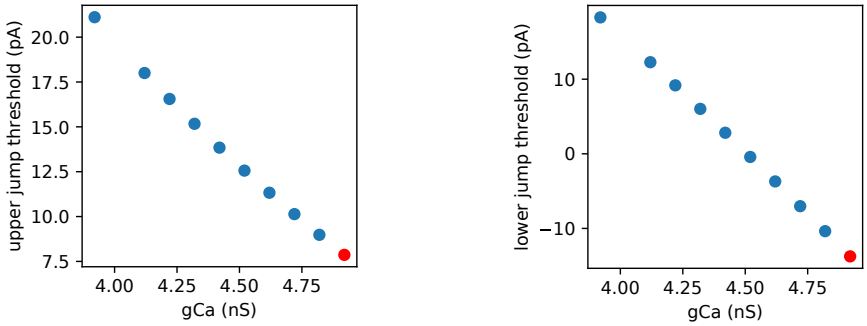

Figure S4: Calcium conductance g_{Ca} against the upper and lower jump thresholds (the WT value in red).

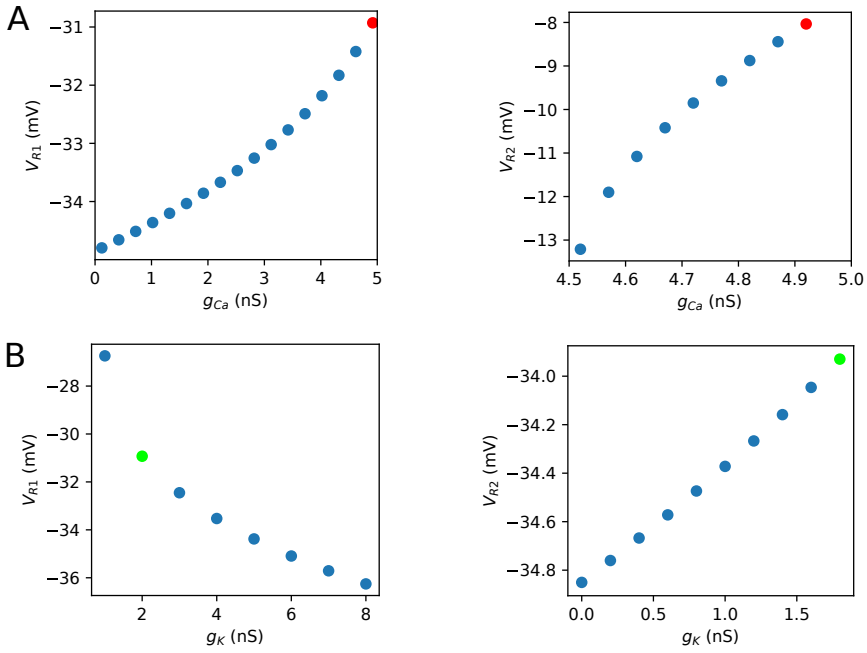

Figure S5: **(A)** Evolution of the two resting potentials V_{R1} and V_{R2} as g_{Ca} reduces (the WT value in red). Note that V_{R2} does not exist for $g_{Ca} < 4.5$ nS. **(B)** Evolution of the two resting potentials V_{R1} and V_{R2} as g_K varies (the WT value in green).

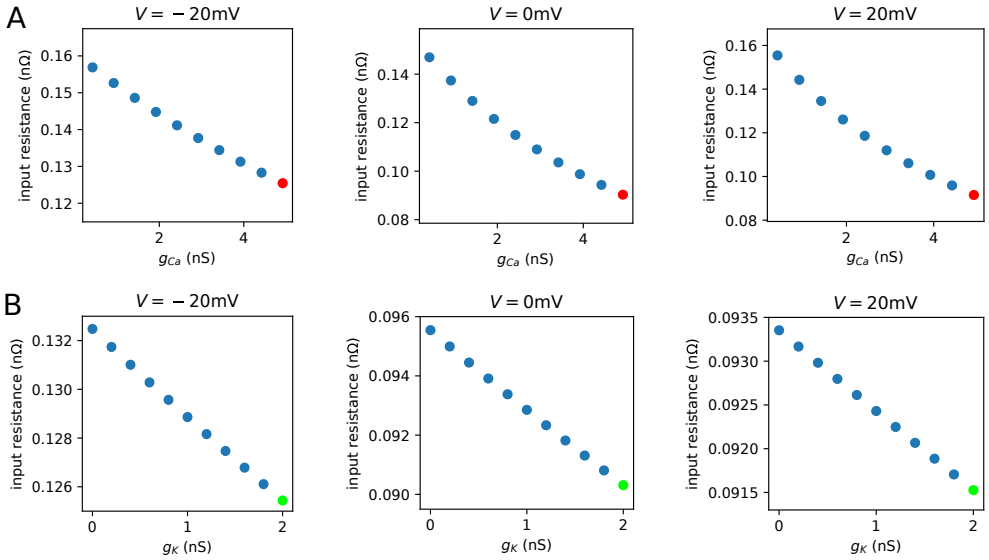

Figure S6: **(A)** Evolution of the input resistance as g_{Ca} decreases (the WT value in red). **(B)** Evolution of the input resistance as g_K decreases (the WT value in green).

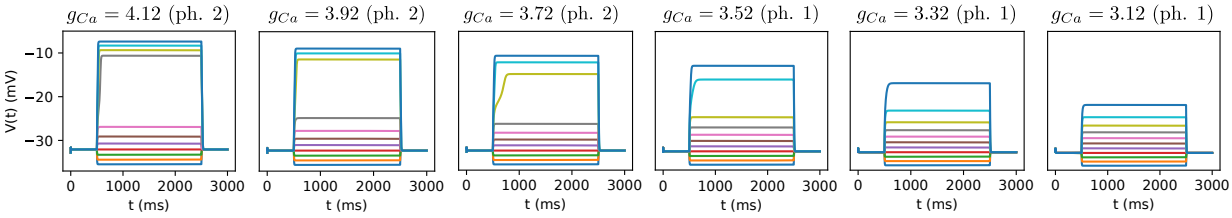

Figure S7: Evolution of the model membrane potentials for a series of current injections initiated from −15 pA and increased to 35 pA in 5 pA increments, for different values of g_{Ca}. The transition between the phenotype (ph.) 2 and 1 is graded in the sense that the amplitude of the voltage jump decreases in a smooth manner.

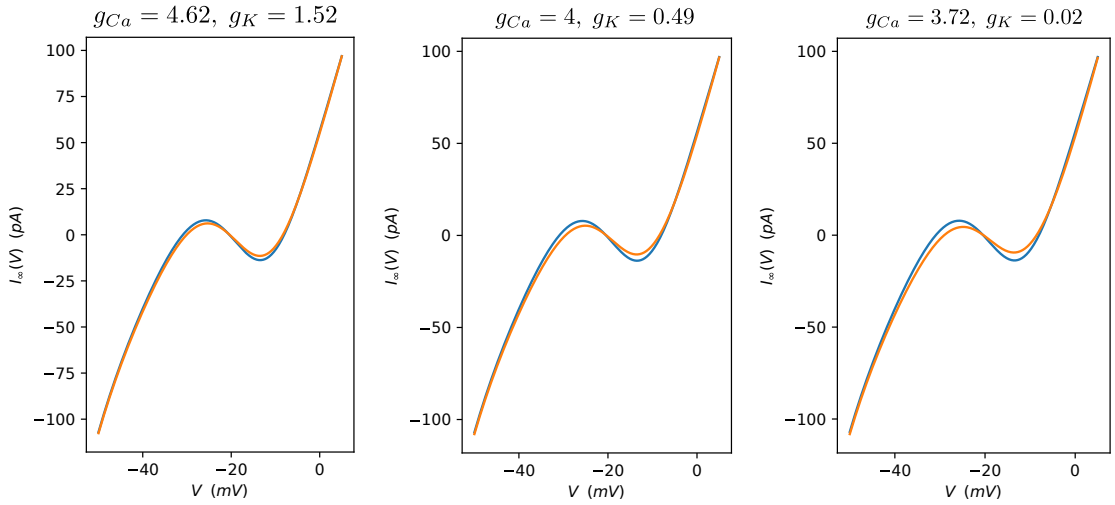

Figure S8: Wild-type steady-state current (in blue), *i.e.* g_{Ca} = 4.92 nS and g_K = 2 nS, against degenerate steady-state current (in orange) obtained from the equation (1) for different optimal compensatory values of g_{Ca} and g_K.

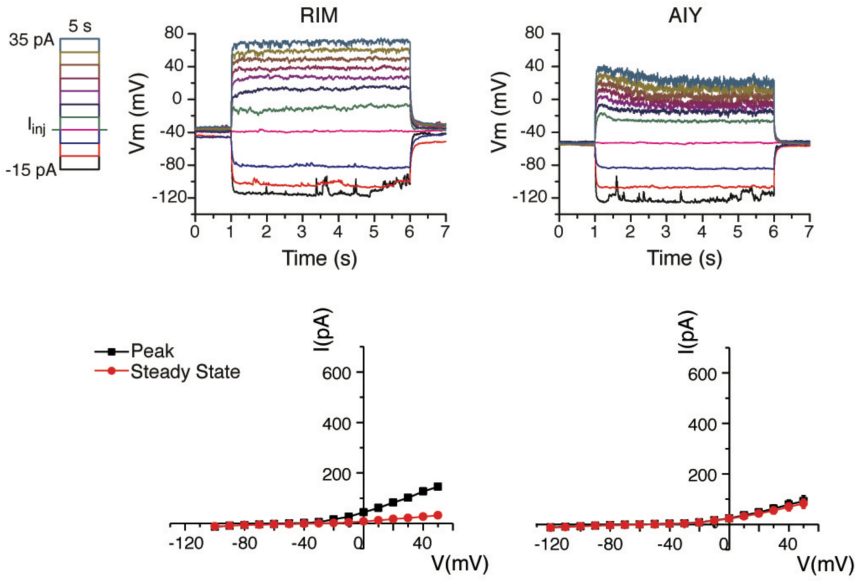

Figure S9: **(Top)** Example of the evolution of membrane potential of phenotype 1 for a series of current injections, in the space of 5 seconds, starting from −15 pA and increasing to 35 pA by 5 pA increments. RIM is depolarized or hyperpolarized in a smooth manner due to the lack of large sustained currents, while AIY is more sensitive to hyperpolarization than depolarization inputs with a transition point around −30mV. **(Bottom)** I-V relationships obtained from averaged voltage-clamp recordings (RIM: n = 3; AIY: n = 7; AFD: n = 3). Peak currents are measured by the absolute maximum amplitude of currents within the first 100 ms of each voltage step onset, while steady-state currents are measured by the averaged currents of the last 50 ms of each voltage step. The experimental data have been reproduced from Liu et al. (2018) with the consent of the authors.