Study of the Sequential nature in neuronal dynamics **Case of study Feeding CPG** Lymnaea stagnalis **Computational approach Experimental approach** 1. 2. Presence of N1 Burst Duration N3 Burst Duration dynamical invariants $R^2 = 0.9718$ $R^2 = 0.0343$ under different cases of stimulation **Universality of** sequential dynamical invariants N1 Burst Duration N3 Burst Duration $R^2 = 0.0438$ $R^2 = 0.9034$ The variability distribution is dependent on the **CPG** activity context 3. 4. Transformation of sequential intervals into effective robot movement Importance of reproducing the functional variability in computational models Light sensory feedback from Functional living CPG circuit Hyperpolarization Burst duration Robot Legs period **Robot legs oscillation** LPPD interva **Stimulation Technique to study it CW-NIR Infrared laser Sustained illumination Activity-dependent protocol** 5. 6. 9. 830nm — 1450nm Intracelular electrode 한 0.70 NIR CW laser .≒ 0.65 ÷ 0.55 Ganglia from Lymnaea stagnalis 20 ms and spike prediction Under the effect of different **Sutained laser stimulation** laser wavelengths, the metric Neural activity accelerates the action potential changes are different The activity dependent protocol allows to assess the action potential sequential generation at 7. different time instants **CW-NIR** laser stimulation of electrically **10.** coupled cells shows the potential of this duration depolarization slope technique to alter circuits dynamics repolarization slope 0.4 8. CGC Sodium gnaP **CGC** Capacitance CGC Potassium gD Aligned spikes 2.00 1.20 1.75 1.15 4.0 0.550 1.50 1.10 0.525 (-100, -80] (-80, -60] (-60, -40] (-40, -20] (-20, 0] (0, 20] (20, 40] Time from illumination offset to spike peak (ms) 3.0 1.25 1.05 0.500 1.00 1.00 2.0 0.475

The closed-loop protocol unveiled the CW-laser effect at different phases of the neuron dynamics

No candidate alone in the model could reproduce the effect and a global change

when simulating the temperature dependency reproduced better the observed effect