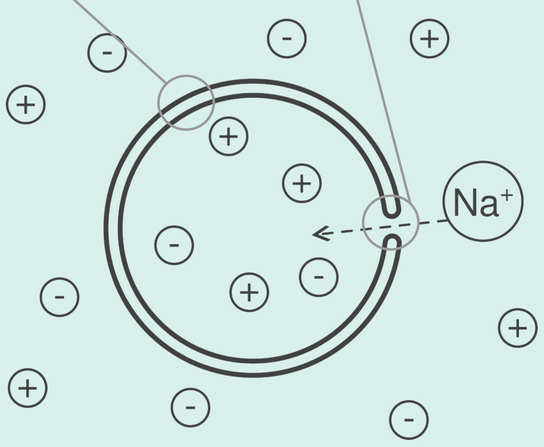
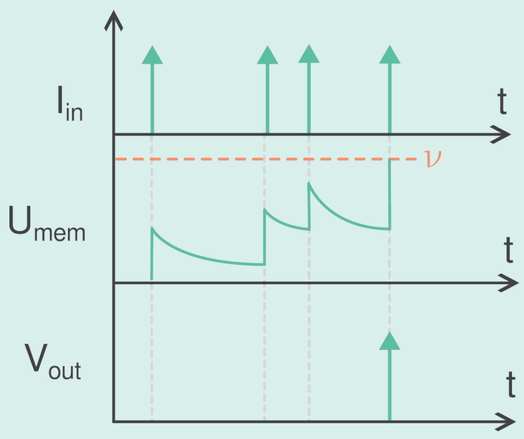
Dopamine Modulation in Leaky Integrate-and-Fire Pattern Generators

Leaky Integrate-and-Fire Neuron Model
Lapicque (1907)

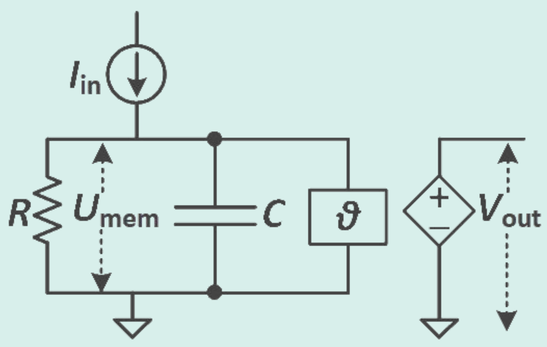
$$C\frac{dU_{\text{mem}}}{dt} = -\frac{U_{\text{mem}}}{R} + I_{\text{in}}(t)$$



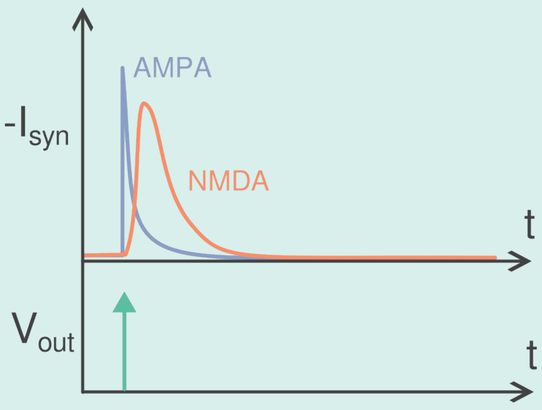
Membrane Potential Dynamics



Circuit Representation



Synaptic Current

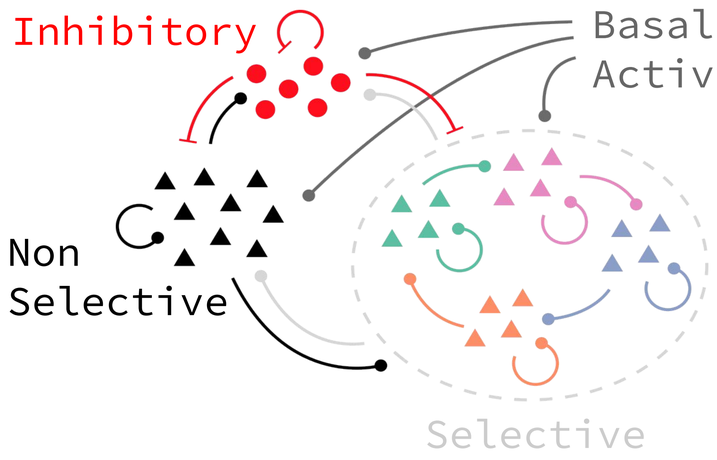


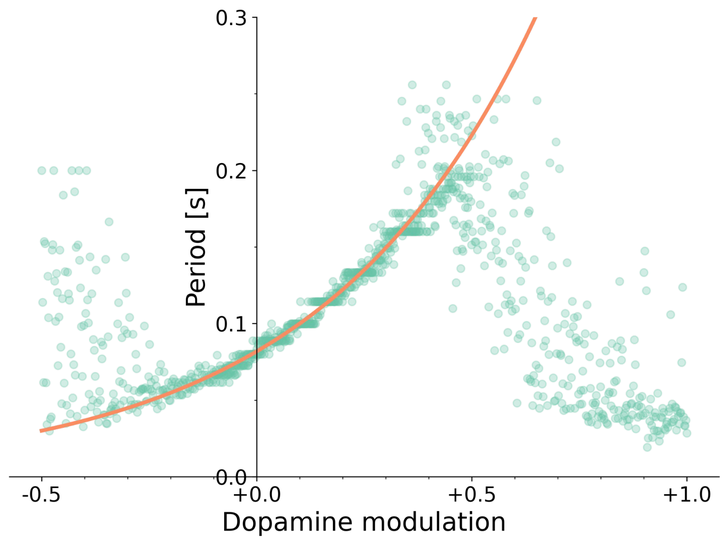
Next Steps

The next steps involve training spiking networks using reinforcement learning to model complex motor behaviors.

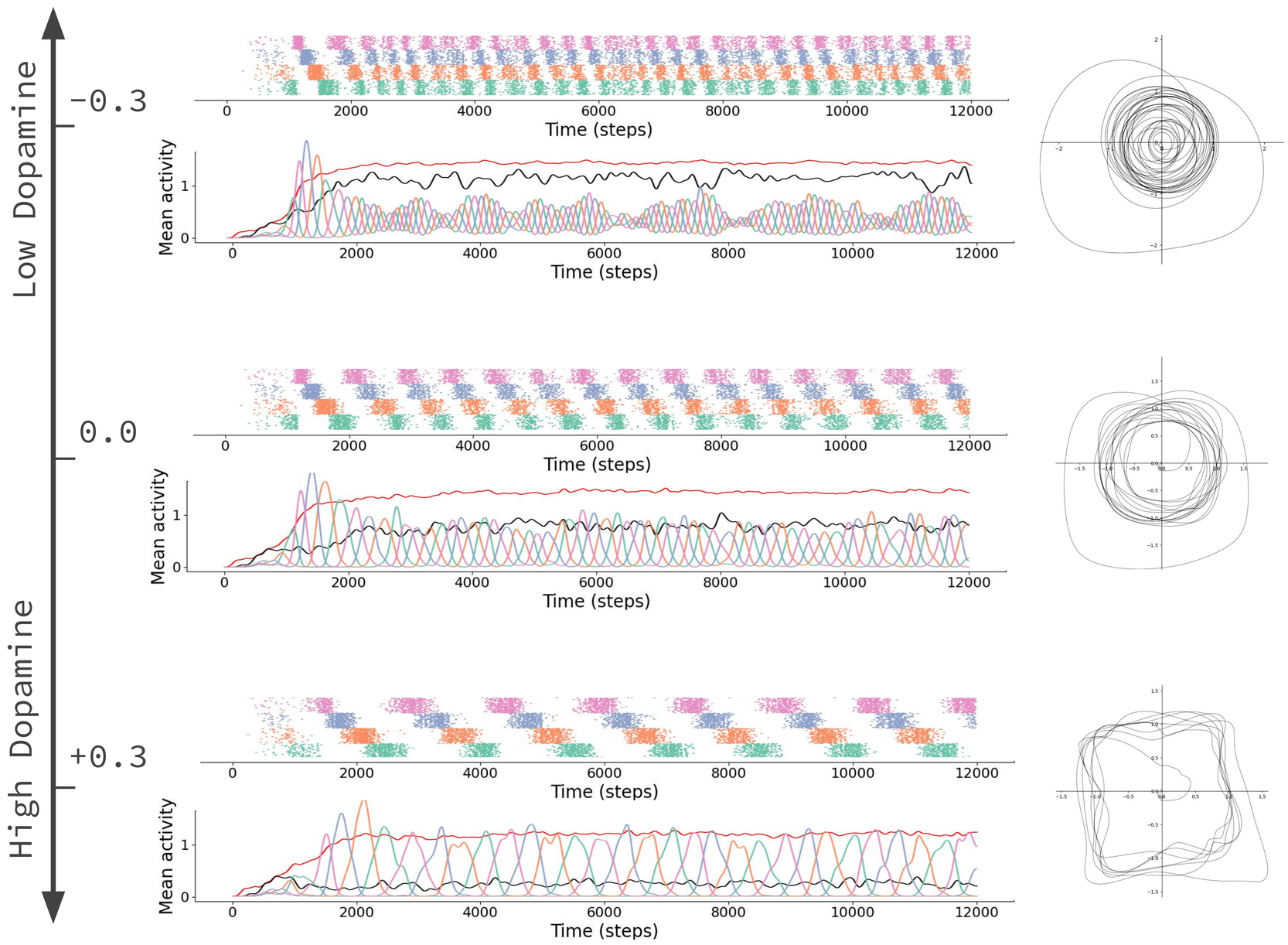
The primary objective is to develop central pattern generators modeled through spiking neural networks.

Oscillatory Behaviour

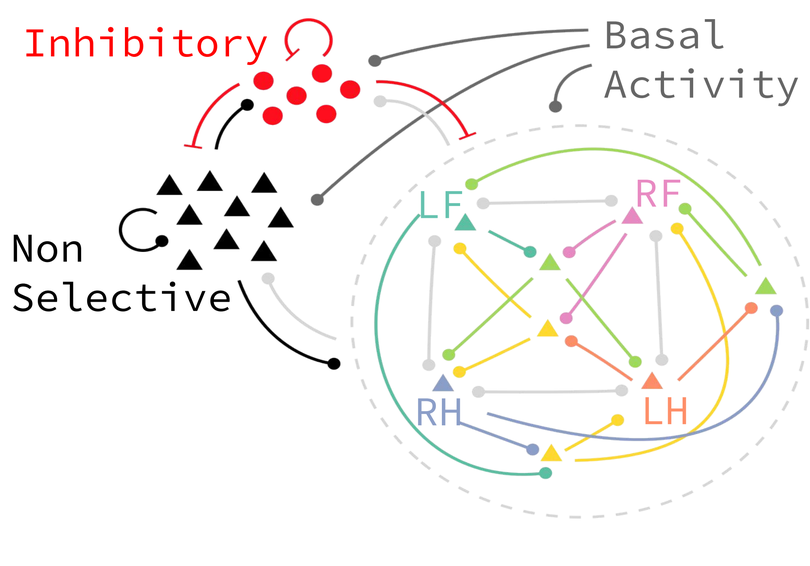


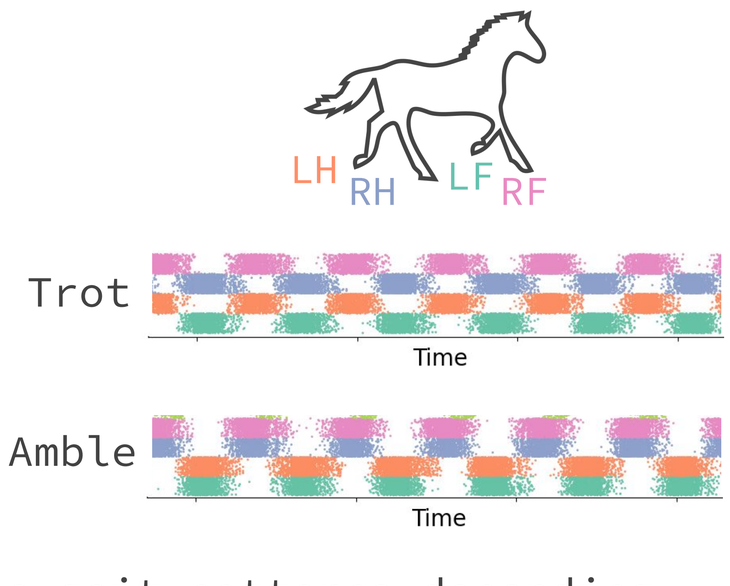


Lower dopamine leads to increased oscillation frequency.



Quadrupedal Gaits





A single structure can produce multiple gait patterns depending on its initialization.

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