Electrophysiology on the Leech

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(medicinal leech)

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Example of P Cell

![Example of P Cell](image)
Example of Synapse

Time (Seconds)

(Volts/10)
Receptors thought to play a role in learning

Glutamate receptors and synaptic plasticity

Voglis and Tavernarakis, 2006
**STDP in Mammals**

![Graph showing STDP in Mammals](image)

- **Normalized EPSP slope (%)**
- **Pre/post spike interval (ms)**

**STDP in leech**

![Graph showing STDP in leech](image)

- **% Change AP EPSP**
- **Interstimulus Interval (ISI)**

Dan and Poo, 2005

Grey and Burrell, 2010
Hurdo verbana
Ventral Face of Leech Ganglion

- Anterior Pagoda cell (AP cell)
- Pressure cells (P cells)

(Todd, 2010)
Adult ganglion light micrograph

AP cell

P cells

(Todd, 2010)

(Gu, 1990)
How to sort out between the 400 different ganglions?

1) Whether the cell fires tonically or not.

2) The characteristic resting membrane potential (RMP) and the characteristic action potential (AP) of the cell which includes AP amplitude, duration, and frequency.

Sample traces from the sensory cells demonstrating the differences in action potentials

(Todd, 2010)
Plan

1) Single cell electrophysiology

2) Dual cell electrophysiology

Todd, 2010
Application of STDP

(Volts)

Time (Seconds)
Long-Term Potentiation

EPSP Amplitude (Volts)

Time (Seconds)
Long-Term Depression

EPSP Amplitude (millivolts)
How does our data compare?

Mammals

Leech

Bi and Poo, 1998
Difficulties

1) Insufficient Time:
   1) Rig set up
   2) Ganglion dissection
   3) Matlab usage

2) Equipment
   1) Noise

3) Exact quantification of variables:
   1) Time
   2) Hyperpolarization

4) Reliable Spikes:
   1) Not always getting spikes
      1) Had to change extent of hyperpolarization