Long Term Potentiation (LTP)

- Terje Lømo discovered LTP through neurophysiological studies on rabbits in 1966.
- LTP is the long-lasting increase of signal transduction between two neurons that results from persistent simultaneous patterns of activity.
- High-frequency stimulation results in an influx of sodium ions, depolarizing the postsynaptic cell and allowing for calcium ions to flow into the cell.
  - Glutamate neurotransmission via NMDA and AMPA receptors is particularly important to LTP.
Long Term Potentiation (LTP)

Long Term Depression (LTD)

- LTD is the weakening of synaptic connections that results from low frequency stimulation.
- Like LTP, LTD involved glutamate, NMDA, and AMPA receptors...
  - However, small changes in calcium concentration during LTD activate different biochemical reactions than those that result during LTP.
- Both LTP and LTD are thought to be essential to learning and memory.
LTP and LTD

https://courses.lumenlearning.com/wm-biology2/chapter/synaptic-plasticity/
Spike Timing Dependent Plasticity (STDP)

- STDP is when the specific timing of spikes effects the sign and magnitude of changes in synaptic strength.
- STDP can be represented as:

\[ \Delta w_j = \sum_{i=1}^{N} \sum_{n=1}^{N} W(t_{n}^{i} - t_{j}^{pre}) \]