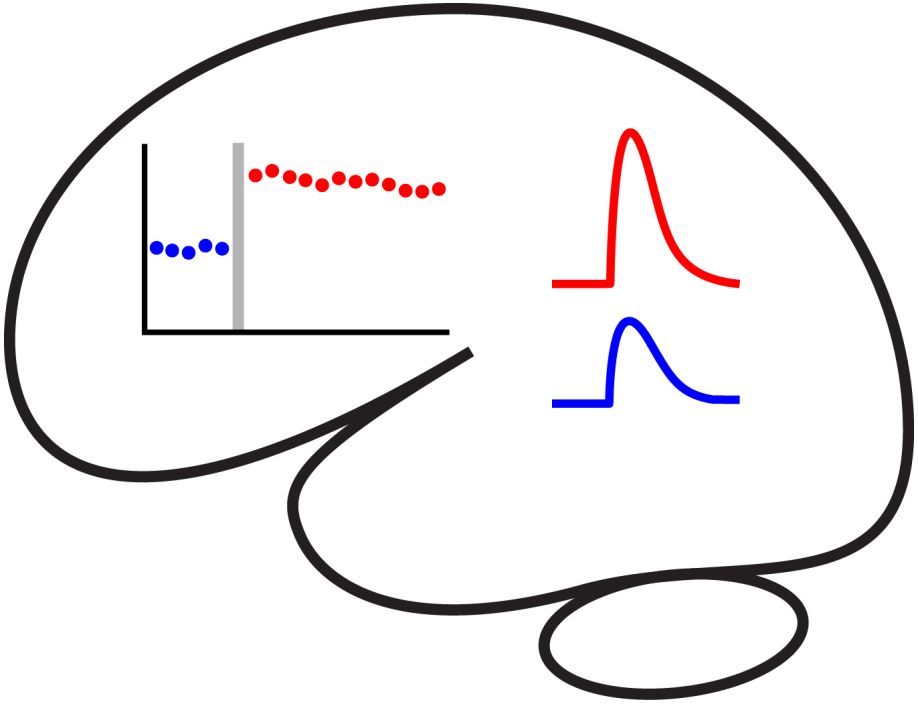
ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE



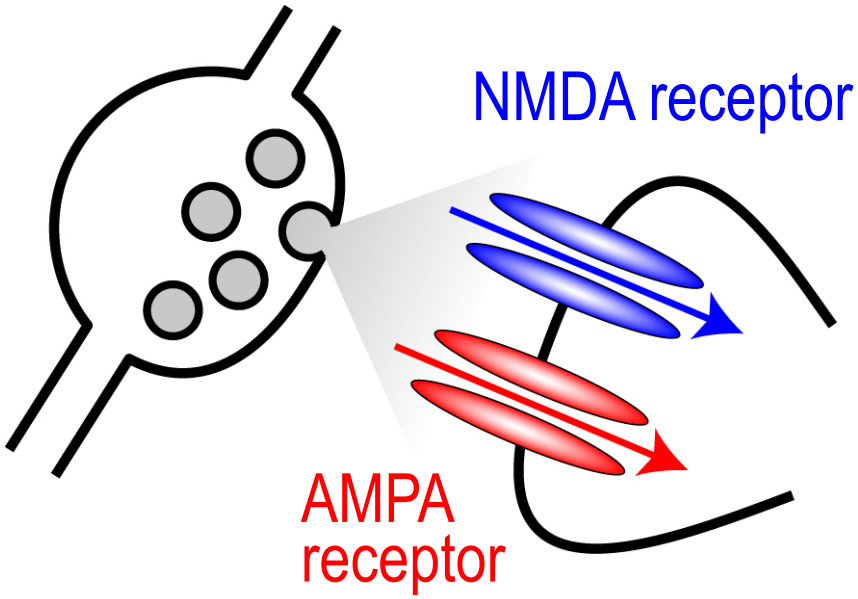
4.4 Synaptic plasticity

Cellular Mechanisms of Brain Function

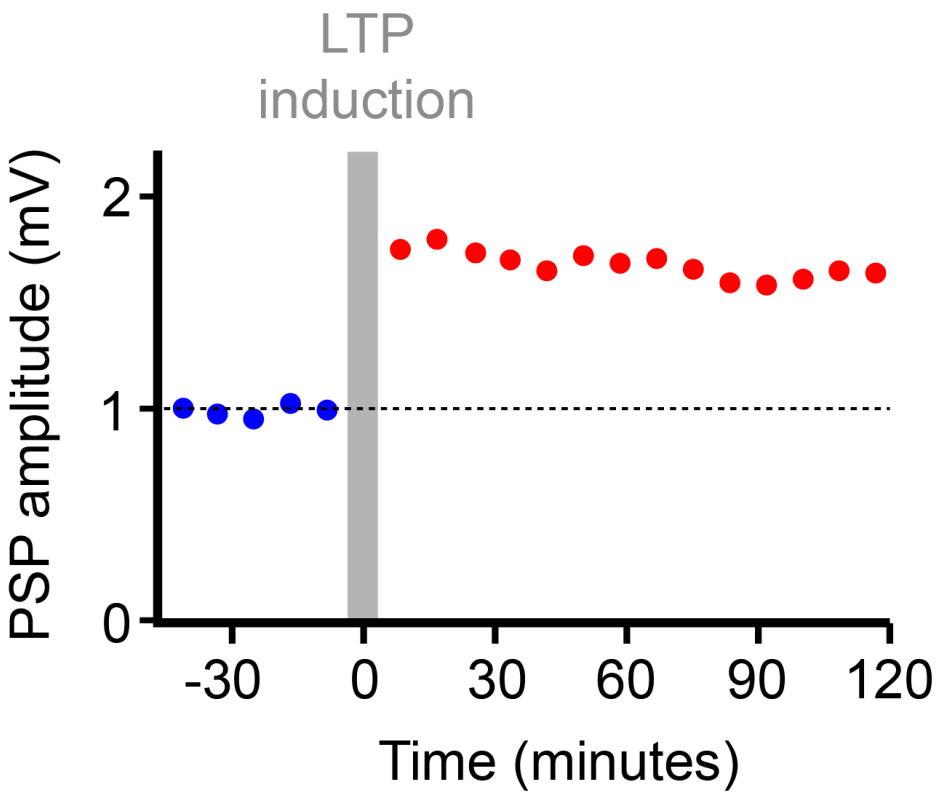
Prof. Carl Petersen

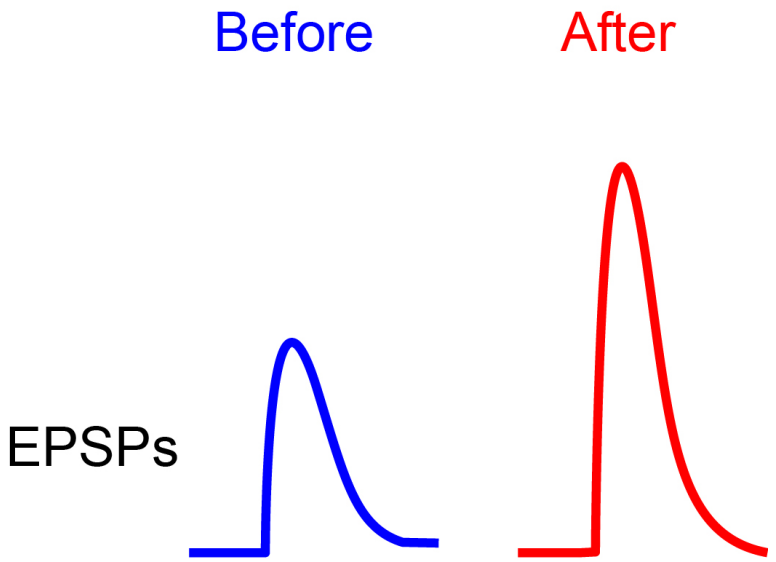
Synaptic plasticity

Postsynaptic plasticity of glutamatergic synapses



Long-term potentiation (LTP)





LTP induction

Experimentally, LTP is often induced by :

i) High frequency (100 Hz) stimulation of many axons

ii) Injecting depolarising current through whole-cell recording pipette during synaptic stimulation

iii) Pairing postsynaptic action potential firing with EPSP input

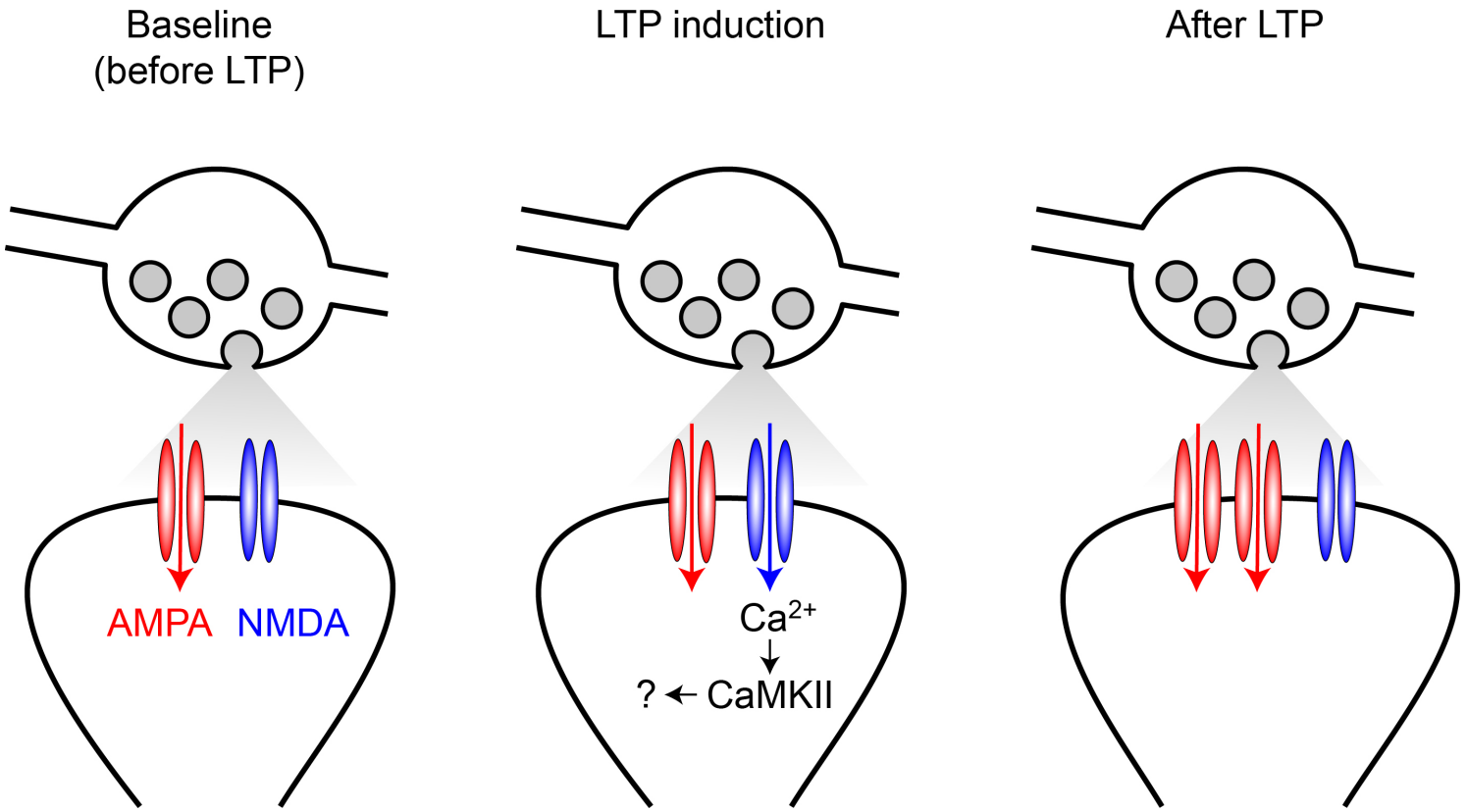
LTP induction requires :

i) NMDA receptor activation

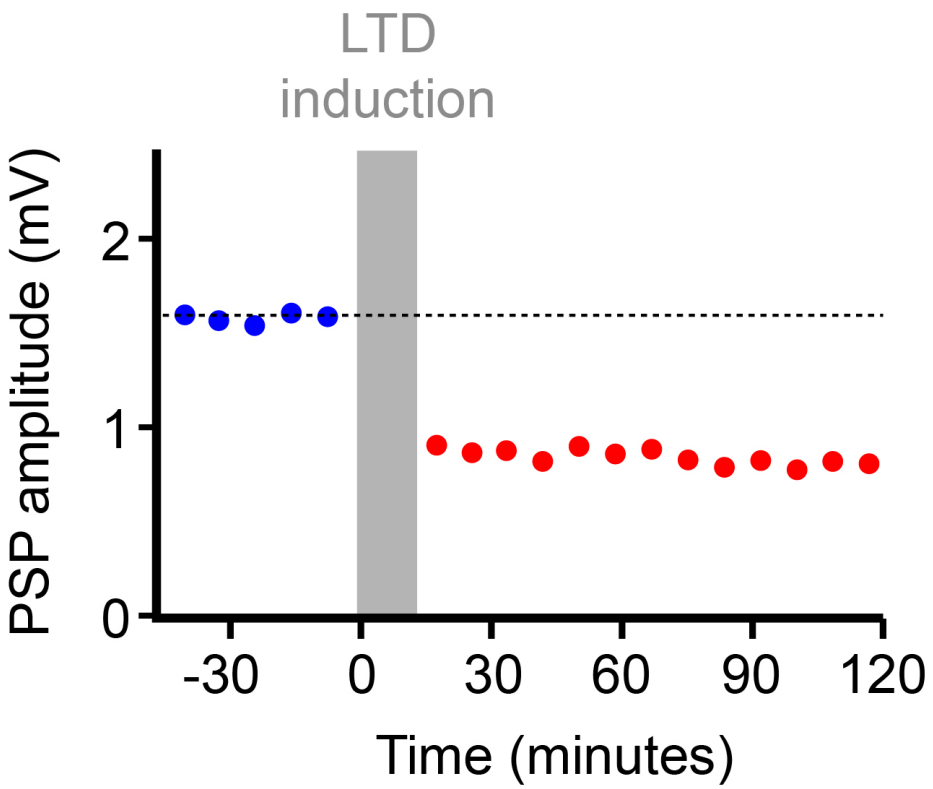
ii) Postsynaptic cytosolic calcium increase

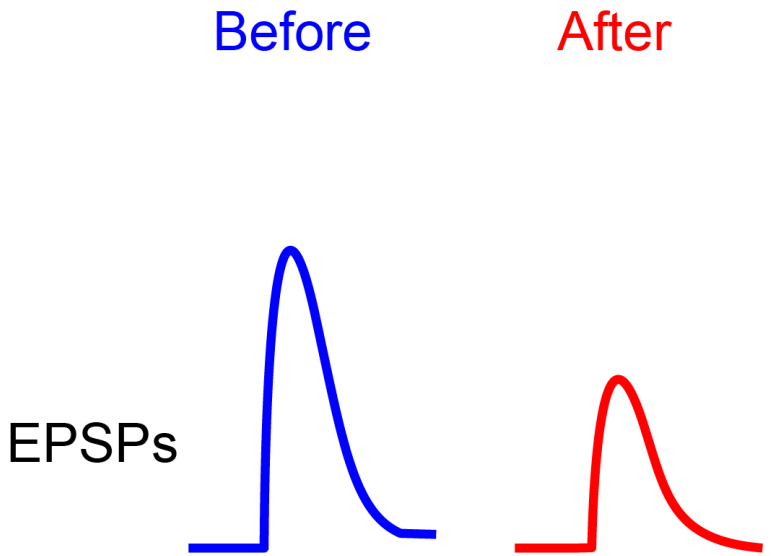
iii) Activation of protein kinases (CaMKII)

Postsynaptic mechanisms of LTP



Long-term depression (LTD)





LTD induction

Experimentally, LTD is often induced by :

i) Repetitive 1 Hz stimulation of many axons

ii) Injecting weak depolarising current through whole-cell recording pipette during synaptic stimulation

LTD induction requires :

i) NMDA receptor activation

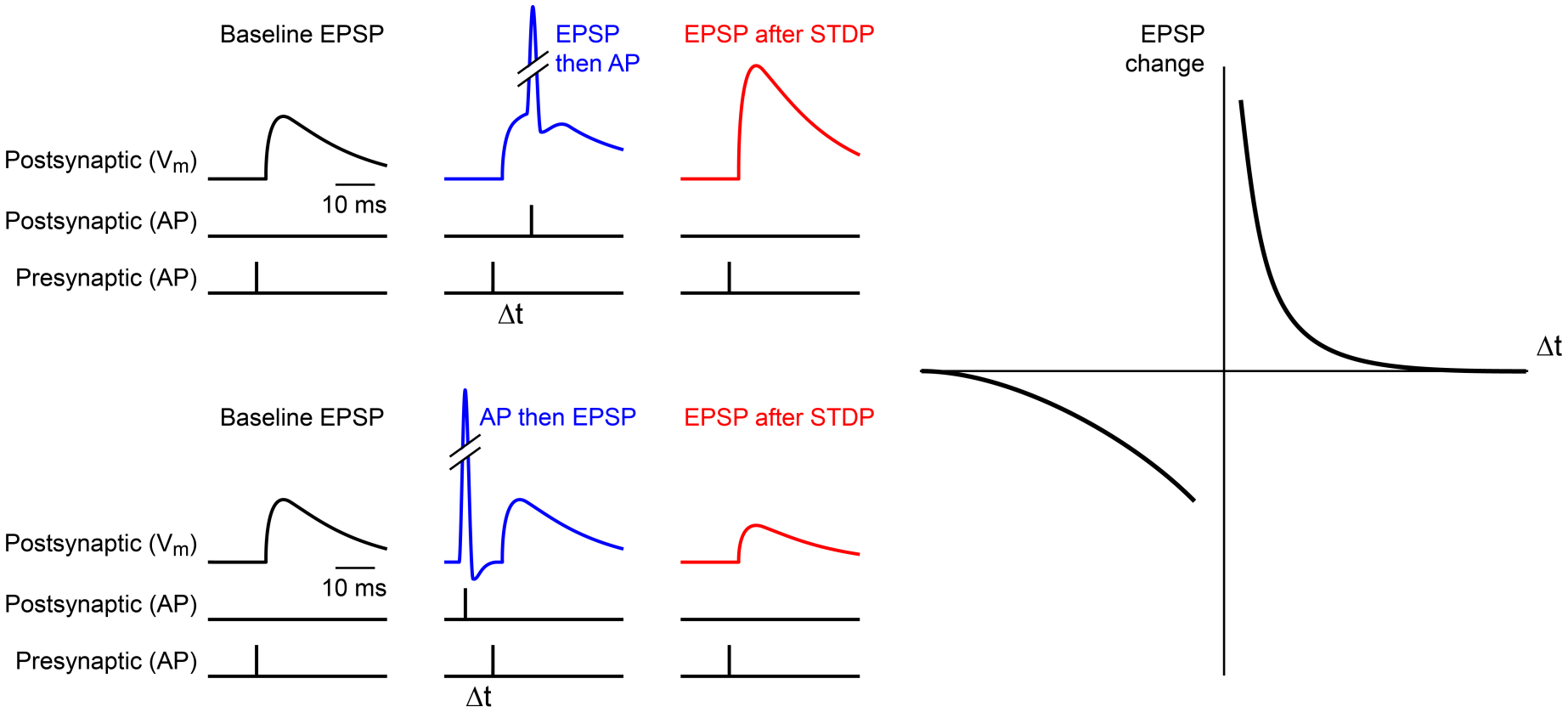
ii) Activation of protein phosphatases (calcineurin)

LTD expression mechanism:

i) Calcineurin-mediated dephosphorylation of AMPA receptors

ii) AMPA receptors removed from synapse

Spike timing-dependent plasticity (STDP)



Postsynaptic plasticity