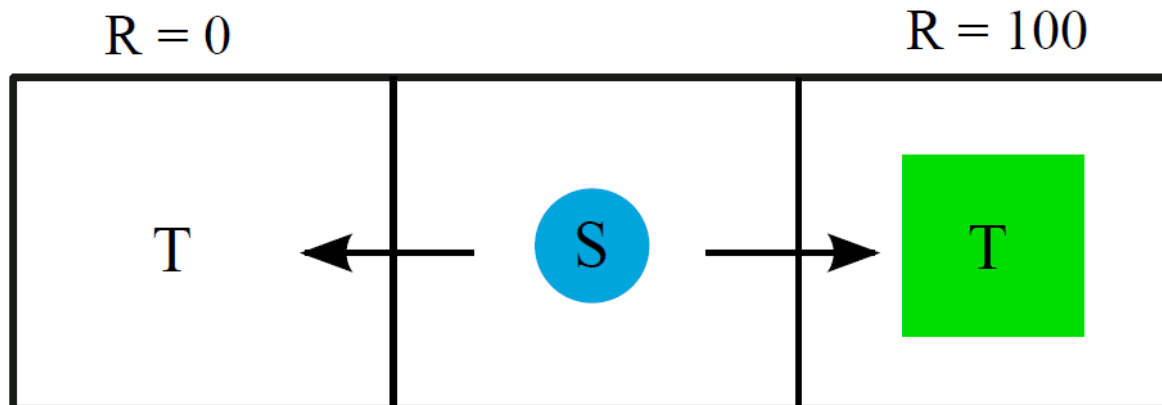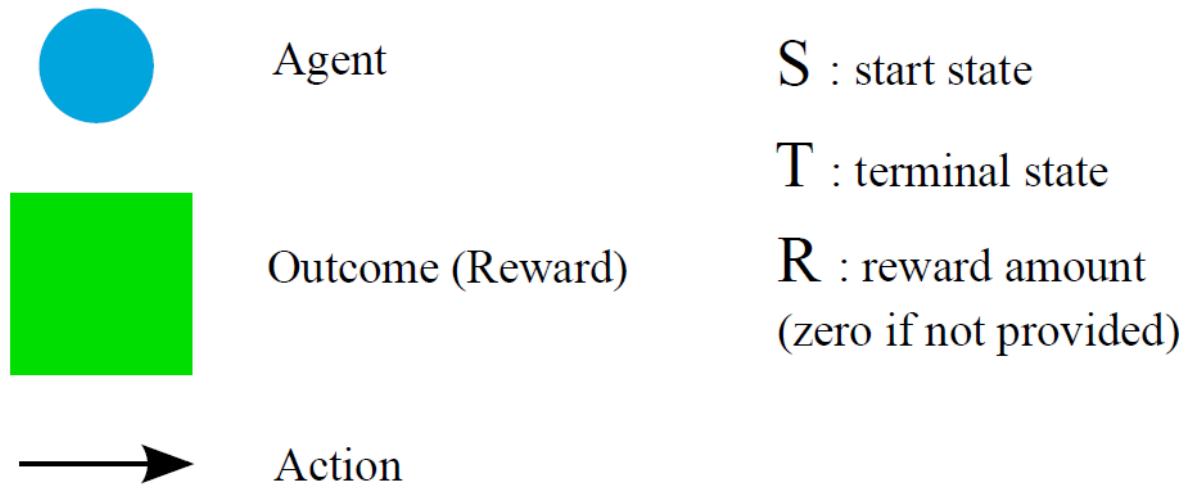# Plasticity and Learning in Neural Circuits
Learning to Play Pong from Reward (and Punishment)

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Functional Neural Circuits Lab (Jülich, Germany)
Lecturers and Tutors : Phillipp Weidel, Susanne Kunkel
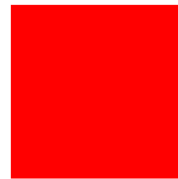
Simple environment : grid world

Agent

Outcome (Reward)

Action

S : start state

T : terminal state

R : reward amount
(zero if not provided)

R = 0

R = 100

T	← S →	T

Simple environment : grid world

Agent

Outcome (Reward)

Outcome (Punishment)

⟶ Action

S : start state

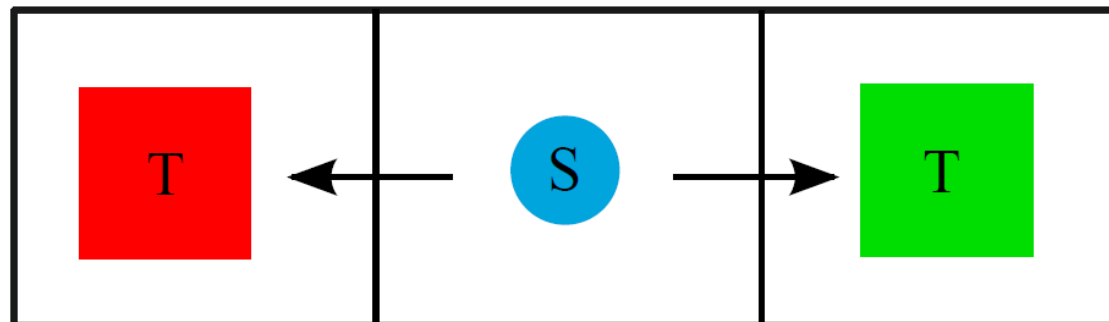T : terminal state

R : reward amount
(zero if not provided,
rewarding if positive,
punishing if negative)

R = -100   R = 600

| T | ← S → | T |

Winner-take-all (WTA) neural circuit

States neuron pools

s_i

$Q(s_i, a_j)$

Action neuron pools

a_j

Inhibitory neuron pool

▲ Excitatory neuron
● Inhibitory neuron
→ Excitatory synapse
→ Inhibitory synapse
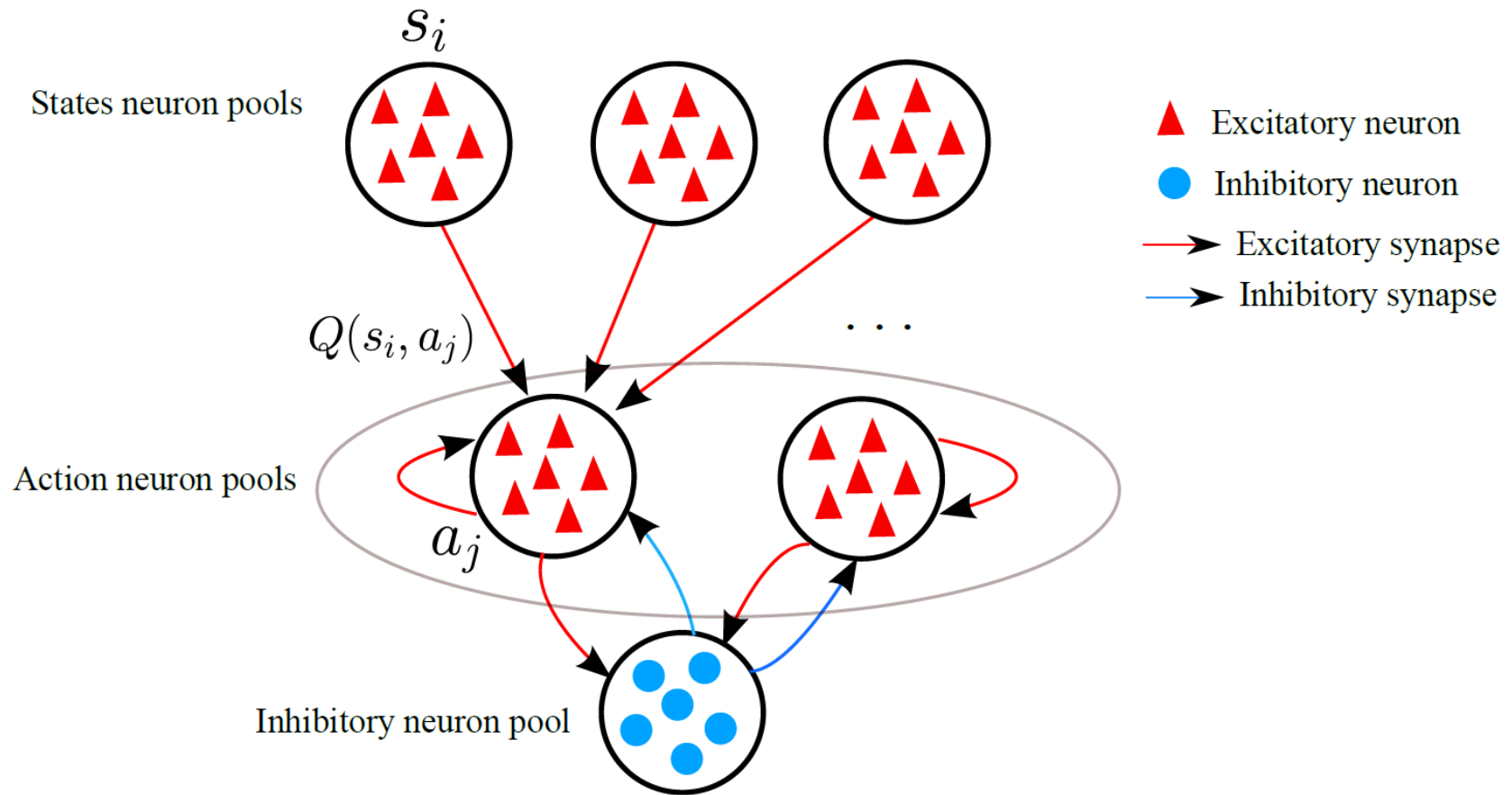
Prediction error driven learning and plasticity