Target Dependent Short-Term Synaptic Plasticity Among Hippocampal Interneurons

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Innervation of pyramidal cells by 12 types of GABAergic interneuron and interneurons by 4 types of interneuron specific cell in the CA1 area of the hippocampus

Bistratified cell

Basket

OLM cell

CA1 Pyramidal Cell

Postsynaptic dependent
Synaptic connectivity and distinct in vivo firing patterns of pyramidal cells and four types of interneurone embedded in the hippocampal network

Method – paired recordings, biocytin labelling and double immunofluorescence

Immunofluorescence

- AMCA
- PV
- CCK

Dual Whole-cell Recordings

- Pyramidal cell
- Interneurons

HRP

Drawing
Control of Inhibition – CCK Positive Interneurones

AMCA               FITC                   HRP
Biocytin            CCK

-70mV

-70mV
Stratum Radiatum Interneurones - Electrically coupled

-70 mV
-60 mV
-55 mV
-70 mV
Short-term synaptic dynamics elicited by SR/SLM Interneurones

- Postsynaptic SR Interneurone
- Presynaptic SR Interneurone

-55mV

0.5 mV

40 mV

50 ms

50 µm

AMCA
FTTC

SO
SP
SR
SLM
Short-term synaptic dynamics elicited by SR/SLM Interneurones

-70mV to +1.5nA
-1.5nA

-70mV to +0.5nA
-1nA
Short-term synaptic dynamics elicited by SP Interneurones

Presynaptic SP Basket cells

Trilaminar interneurone

Postsynaptic Pyramidal cell

-52mV

-59mV

-57mV

-69mV
Control of Inhibition – Presynaptic Cannabinoid Receptors

DSI Protocol

Postsynaptic Pyramid

Presynaptic Interneurone

Control

Anandamide

AM-251

IPSP Amplitude (mV)

Time (min)

0 5 10 15 20 25 30

0 2 4 6

Control

AM-251 +DSI

Shaffer Collateral Associated Interneurones

CCK, CB

Pre

Post
Conclusions

SO
SP
SR
SLM

GABA Receptors
CB1 Rs

Brief train facilitation

Shaffer Collateral Associated Interneurones
CCK, CB

Postsynaptic Excitability

Control

Endogenous Cannabinoids

CB1 R agonist/DSI

CB1 Rs

GABA Receptors

VIP Positive Interneurone

Control

Delayed onset facilitation
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