

# Presynaptic inhibition of GABA<sub>A</sub> mediated unitary IPSPs by Cannabinoid receptors at synapses innervated by CCK positive interneurons in rat CA1

Afia B. Ali

Department of Pharmacology, The School of Pharmacy University of London

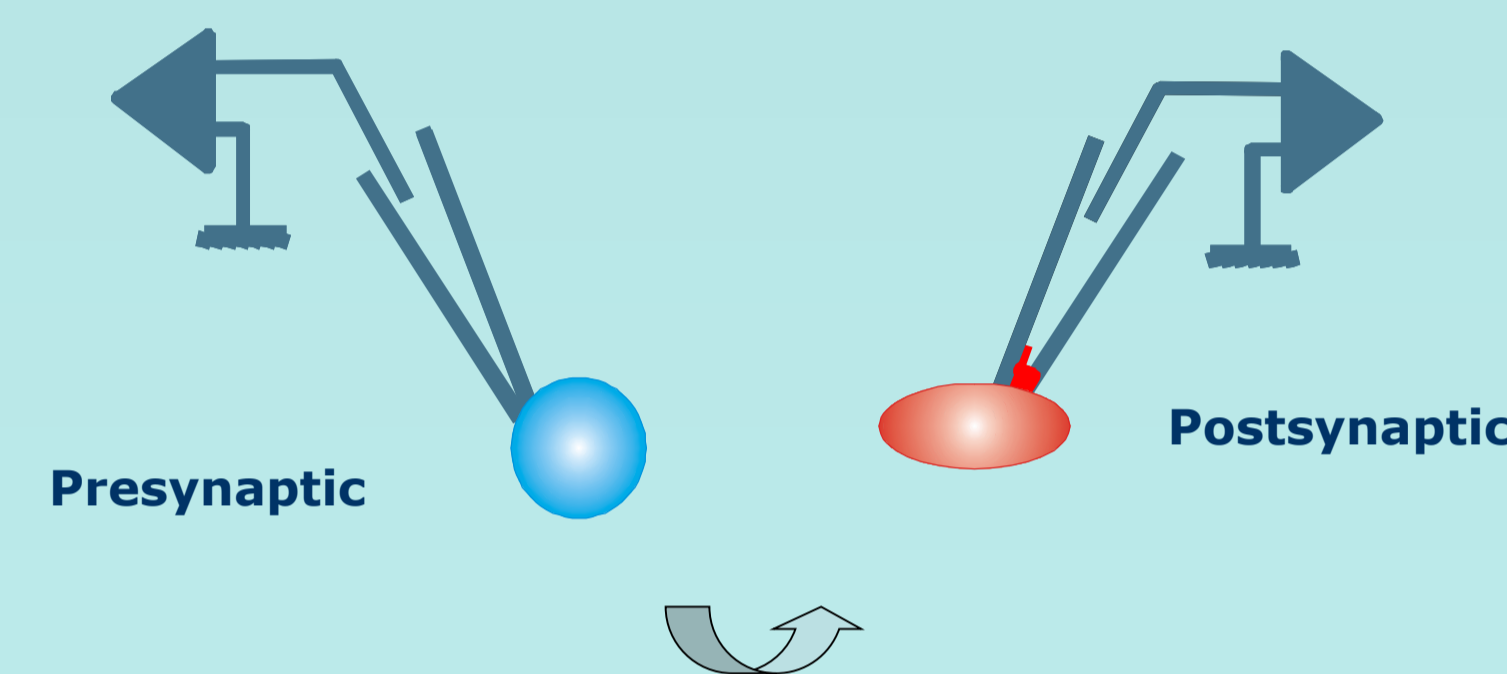


## 1. Introduction

Local circuit connections among interneurons and the modulatory interactions between different classes of interneurons was studied to enhance our understanding of cortical network behaviour by determining the various ways inhibitory interneurons communicate with each other and how excitation is governed at a unitary level.

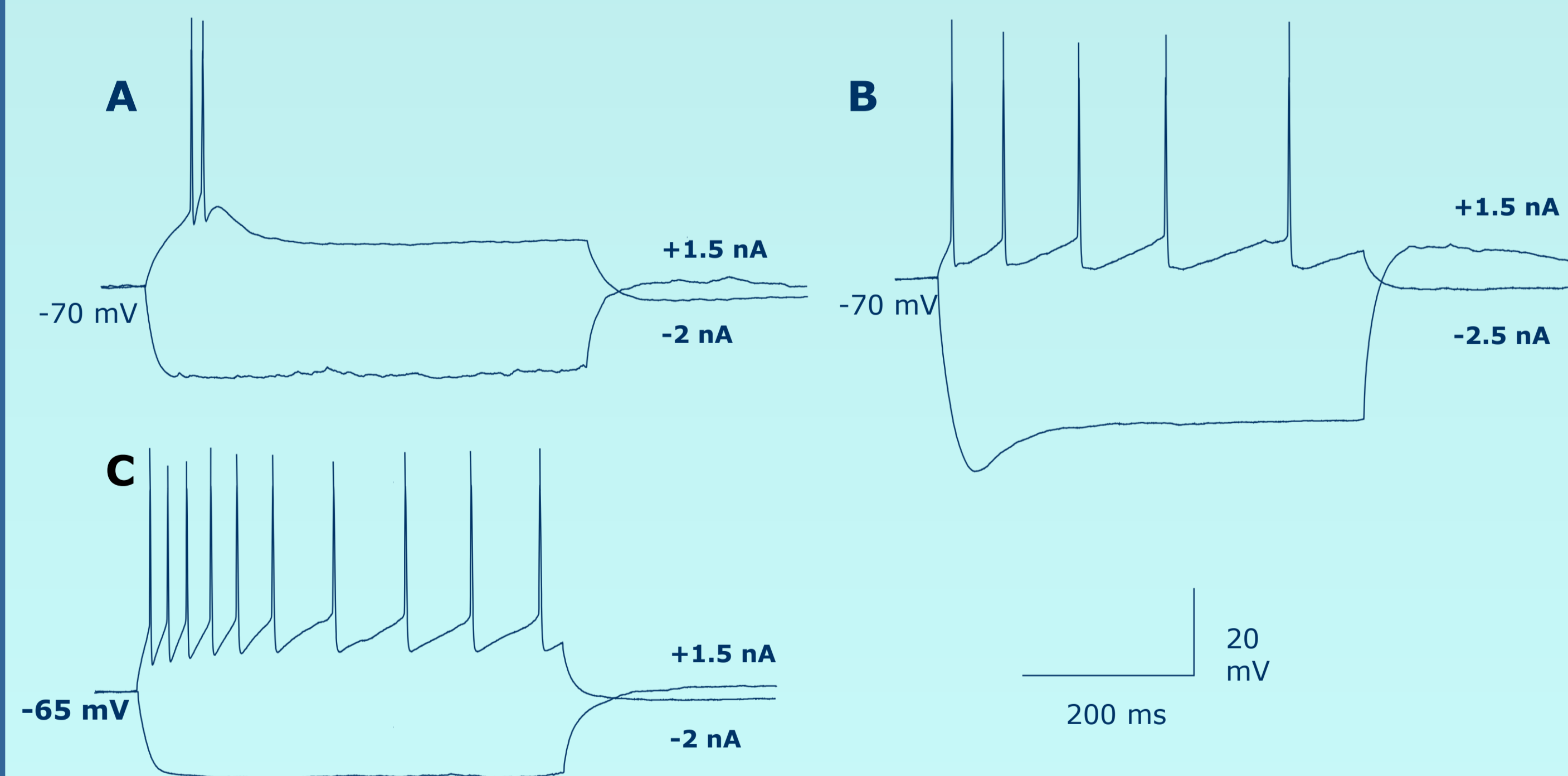
## 2. Method

Dual whole-cell recordings between Stratum Radiatum (SR) interneurons, combined with double immunofluorescence and biocytin labelling was performed in acute slices of the CA1 region of 18-22 day old rat hippocampus.



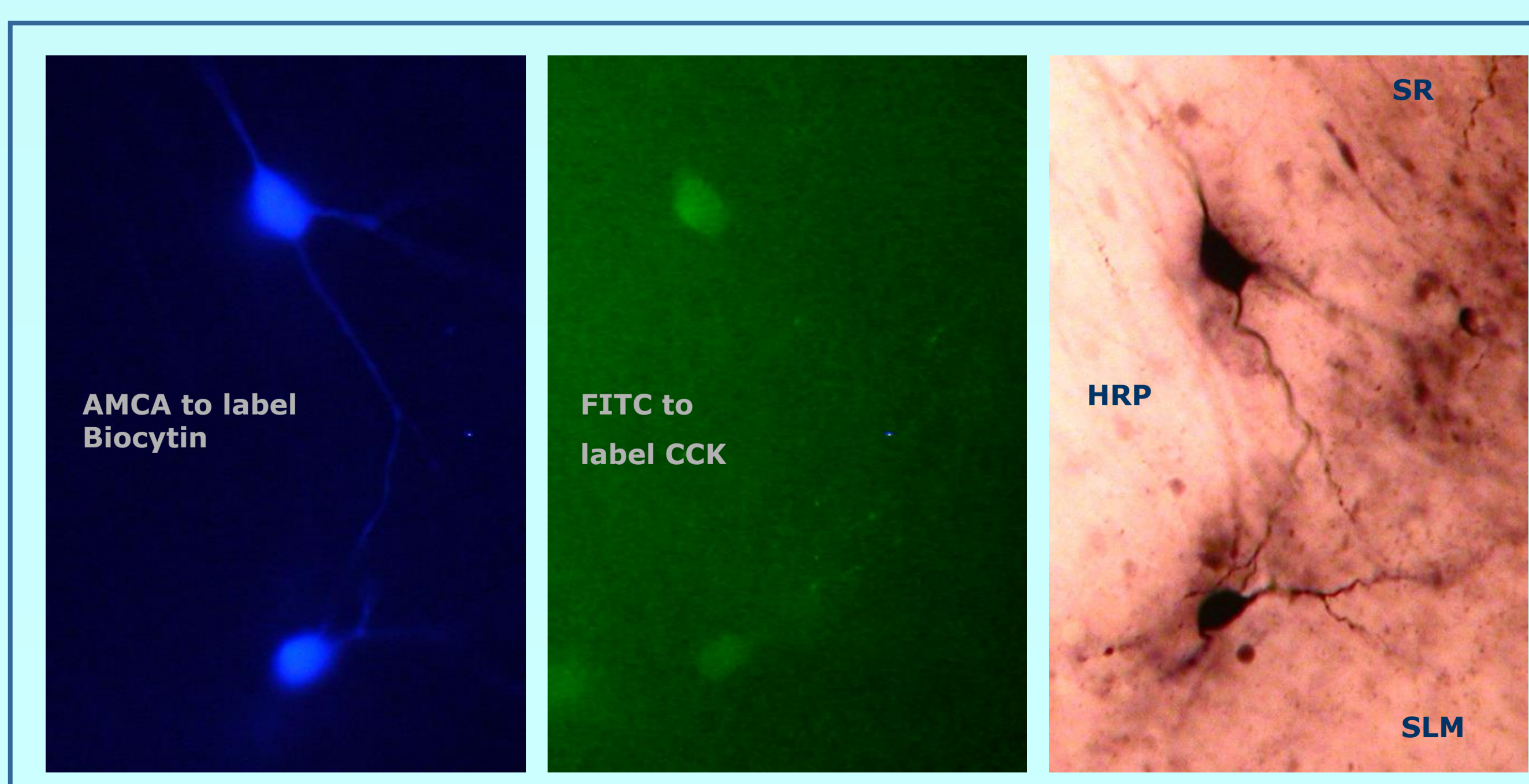
## 3. Electrophysiological properties of SR and SLM

SR/SLM interneurons displayed a range of firing properties, burst firing (A) or an adapting firing pattern with (B) or without (C) a "sag" in response to hyperpolarising current injection.

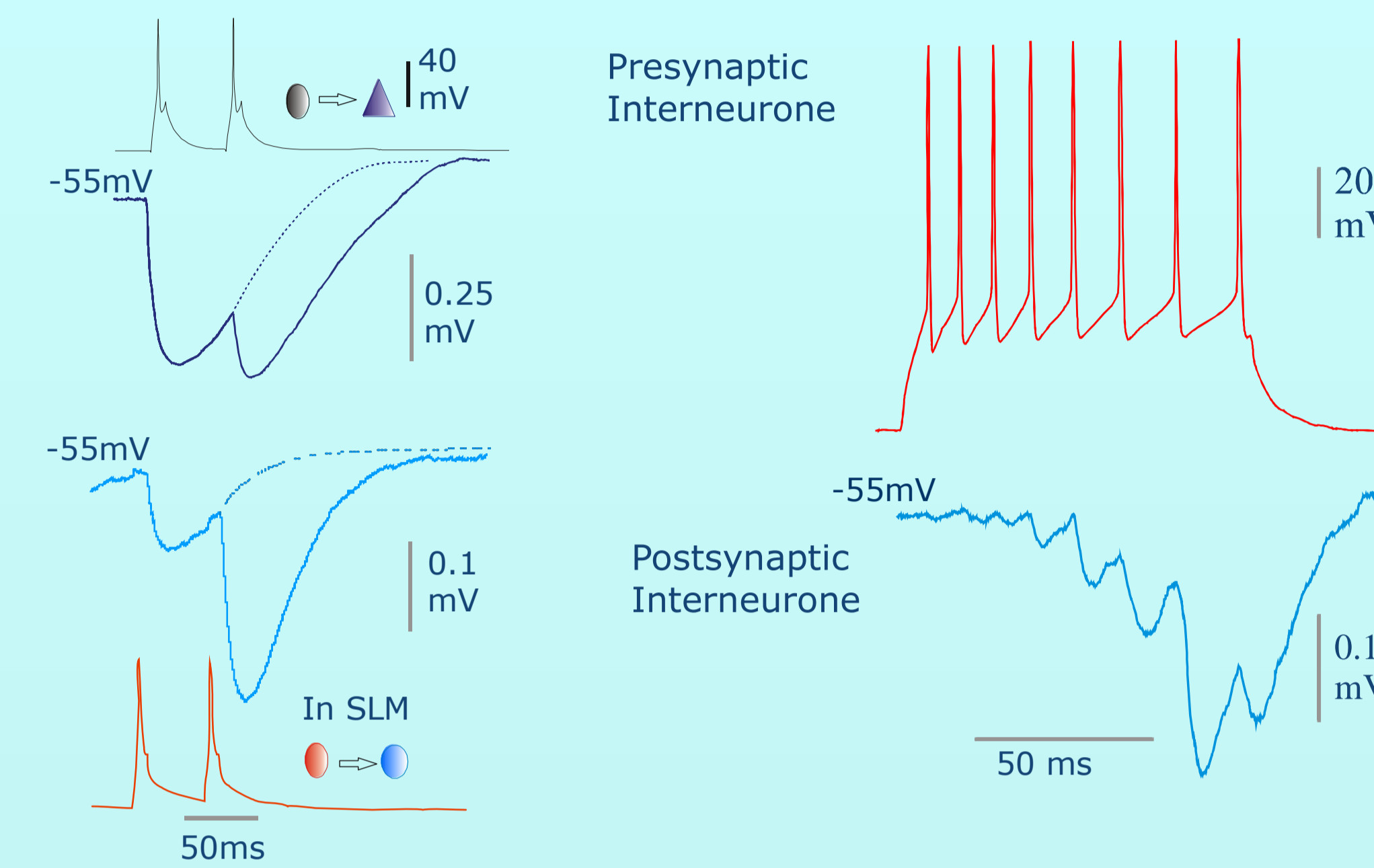


## 4. Anatomical properties of SR/SLM interneurons

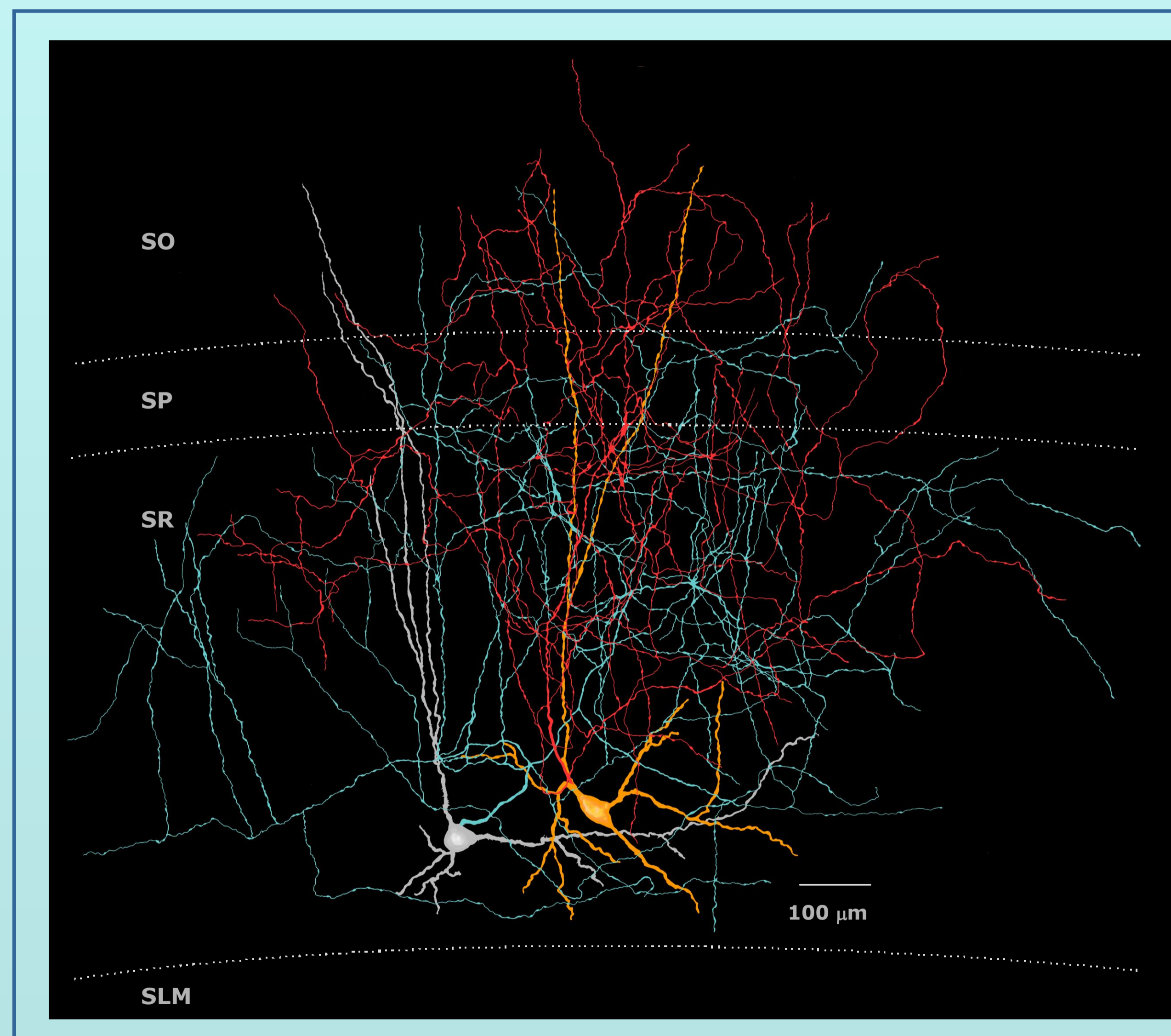
The interneurons selected for this study had bipolar or multipolar cell bodies located in SR. Their sparsely spiny dendrites projected towards stratum pyramidale, and along SR. In this example both cells were immunopositive for CCK.



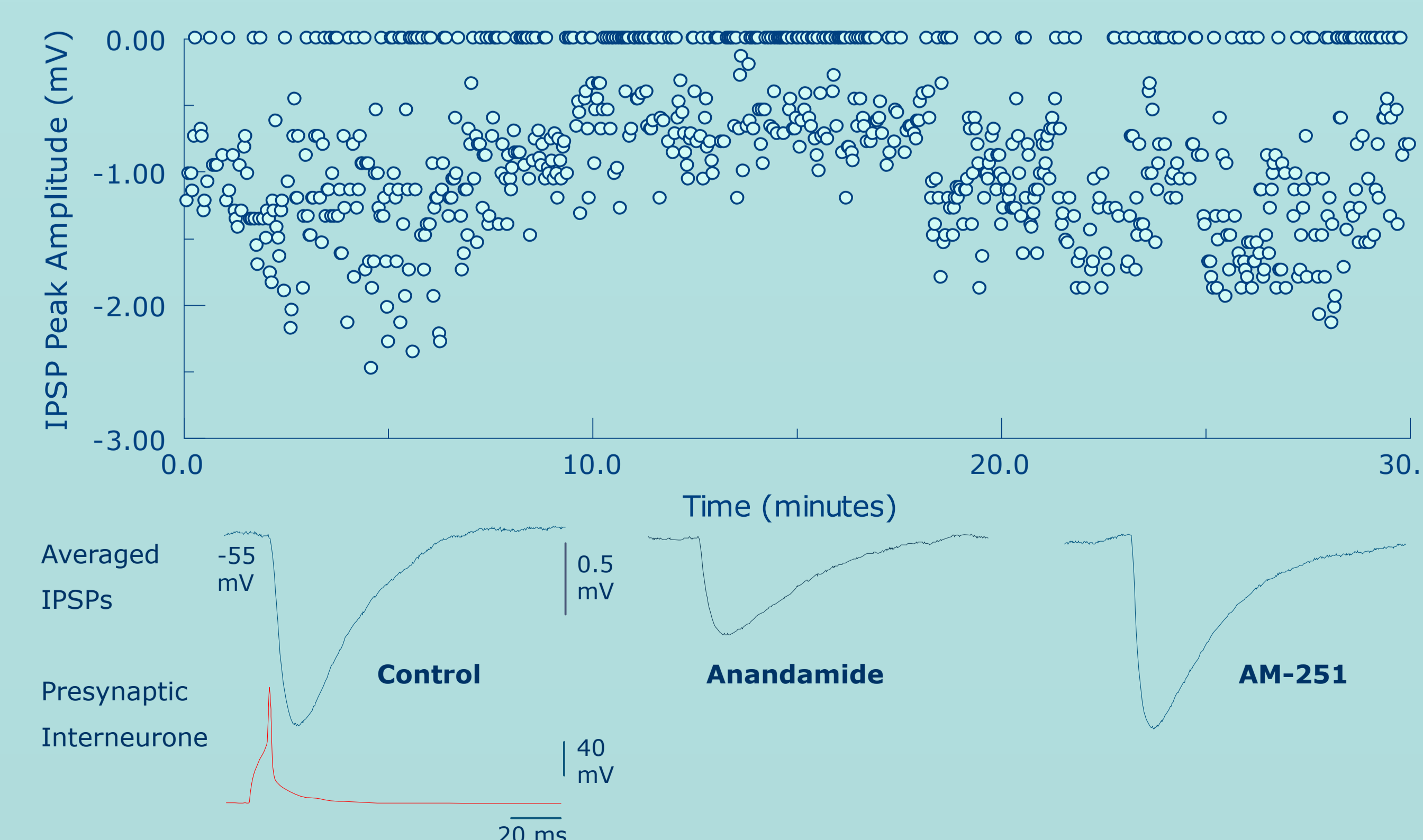
## 5. Fast IPSPs elicited in postsynaptic SR interneurons by presynaptic CCK interneurons displayed powerful facilitation and augmentation in contrast to depression seen at inhibitory inputs to pyramids by a variety of presynaptic interneurons.



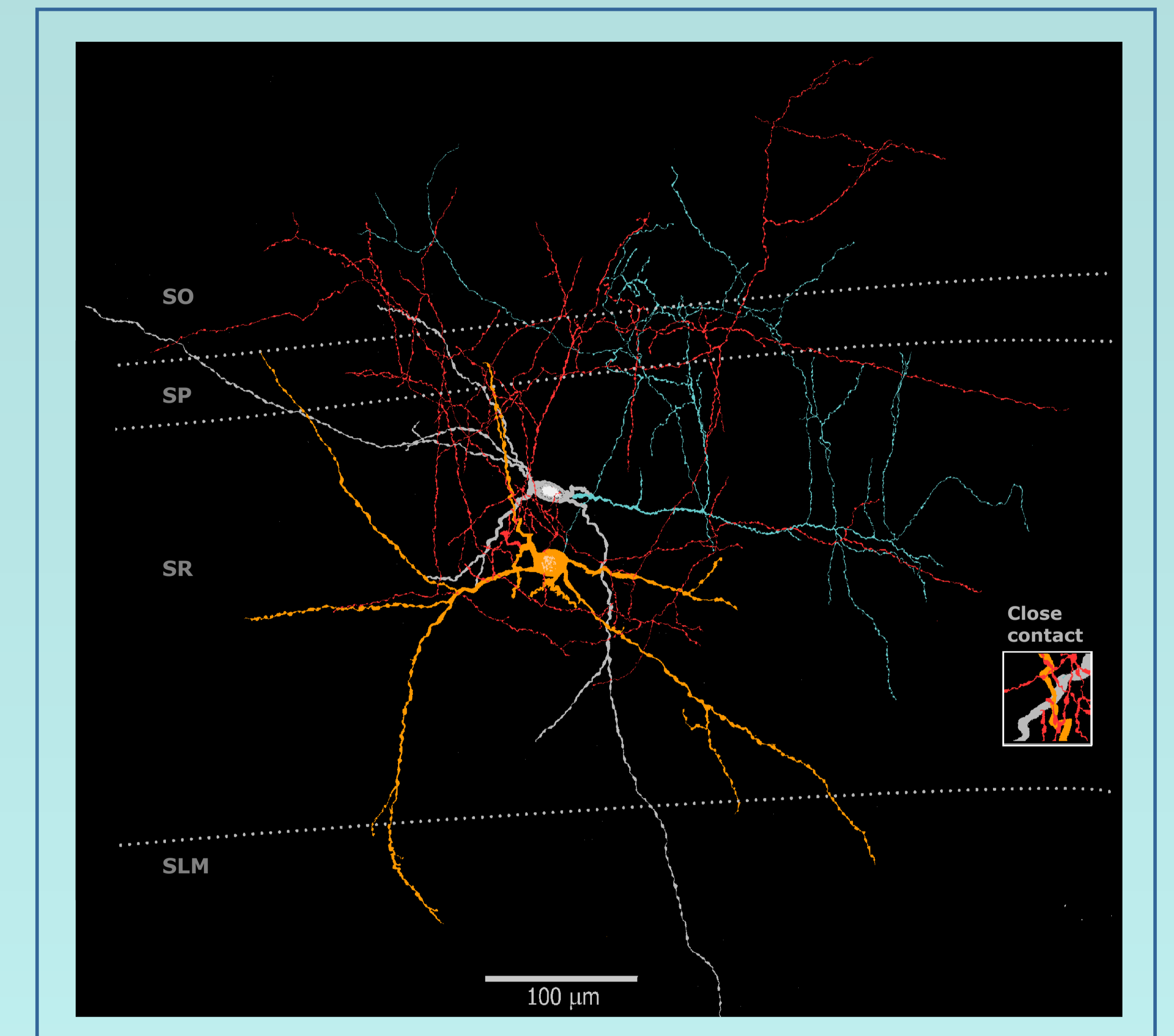
## 6. Synaptically connected interneurons in SR are sensitive to CB1 receptor pharmacology.



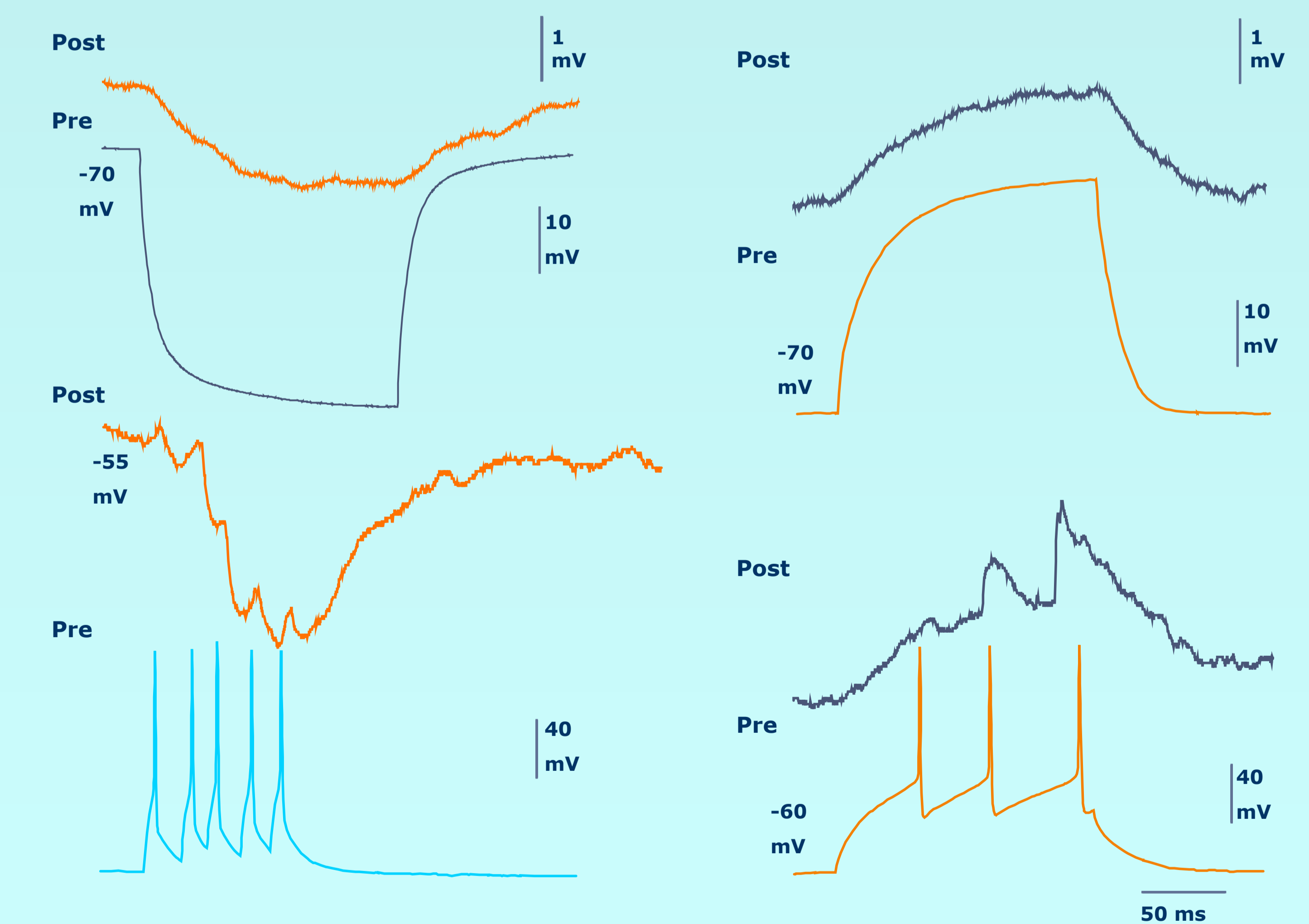
IPSPs recorded from the pair of neurons illustrated above were sensitive to CB1 receptor agonist, Anandamide (14μM), which suppressed IPSPs and increased the number of apparent failures of transmission. CB1 receptor antagonist, AM-251 (5μM) reversed the action of Anandamide, illustrated in the plot below.



## 7. Chemical connections as well as electrical coupling often connected pairs of interneurons in SR.



The passive transfer of voltage from one interneuron to the other demonstrates the electrical coupling between these two interneurons. In this example the blue cell was also chemically connected.



## 8. Conclusion

Interneurons in SR receive facilitating IPSPs in striking contrast to the depression typically seen at inhibitory inputs onto pyramids from several classes of presynaptic interneurons including CCK-baskets. The delayed onset of inhibition regulated by presynaptic CB1 receptors in these interneurons may play an important role in their spike timing.

## Acknowledgments

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