Cortical Regulation of Pain: Mechanisms and Translation

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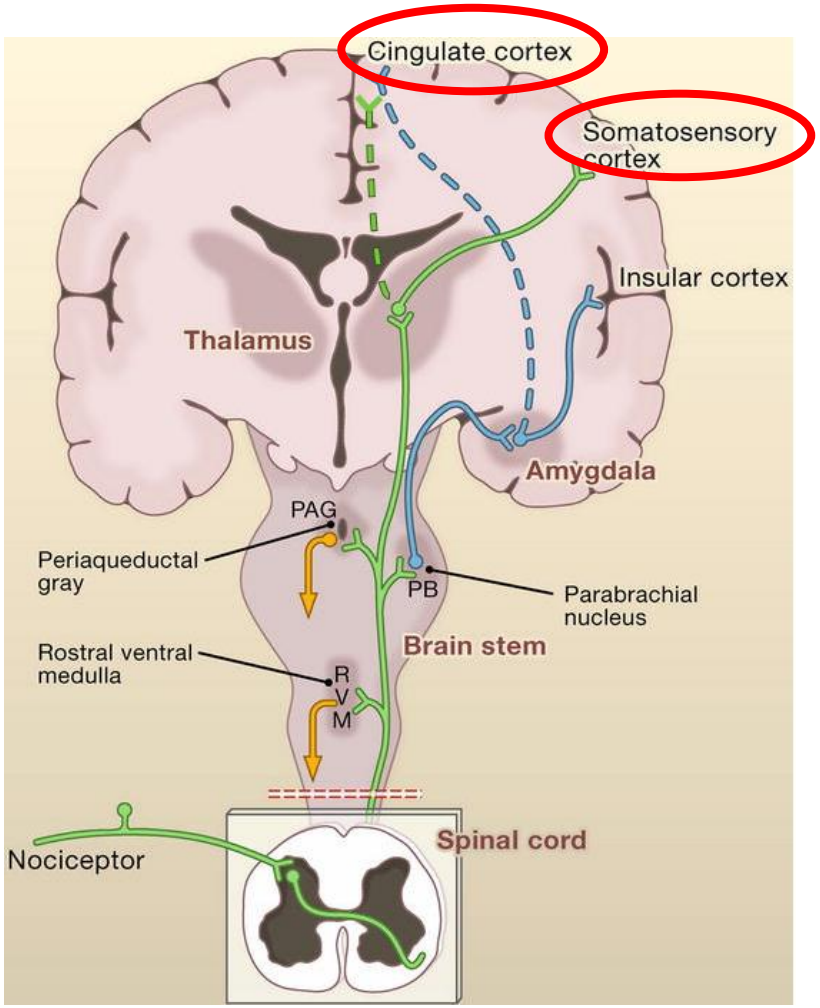
How do sensory and affective pain pathways interact?

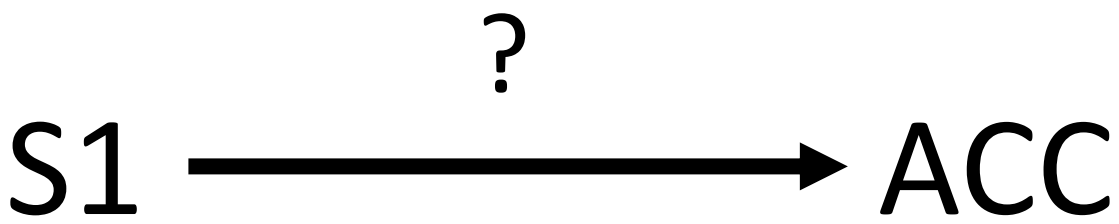
- How is information from somatosensory cortex used in pain perception?
- S1 encodes for sensory information of pain
- ACC suggested to be involved in processing aversive component of pain



Chen et al. 2013

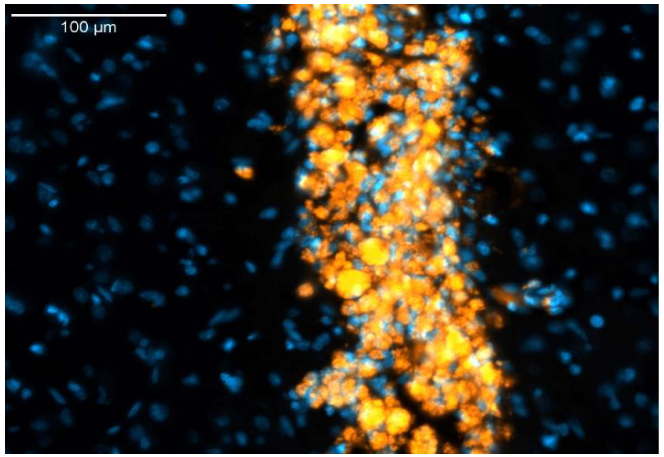
Focus on S1 and ACC

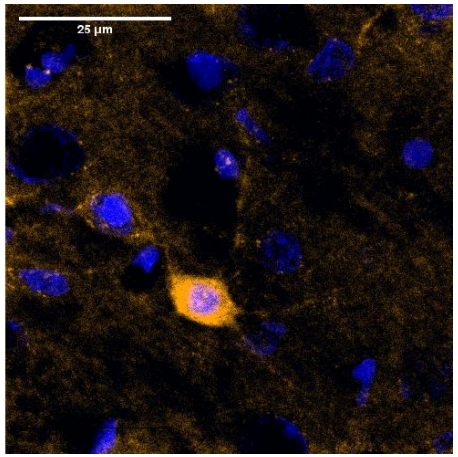
- We hypothesize that S1 has excitatory projections to ACC that influence pain behavior
- Activation of these neurons may exacerbate aversive reaction to pain
- Inhibition of these neurons may provide some degree of analgesia



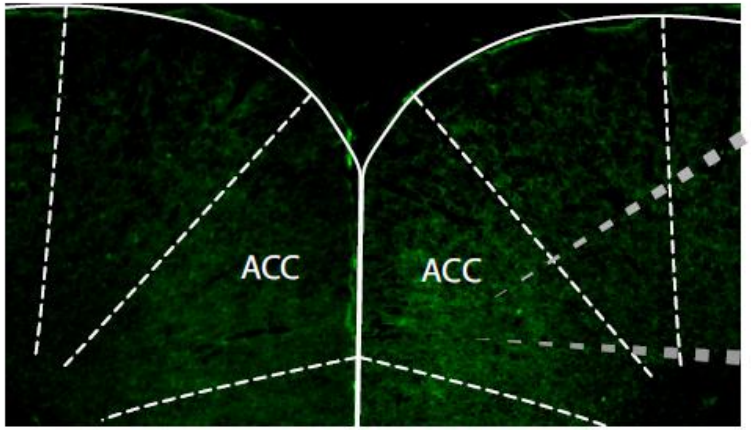
Confirmed presence of S1->ACC projections

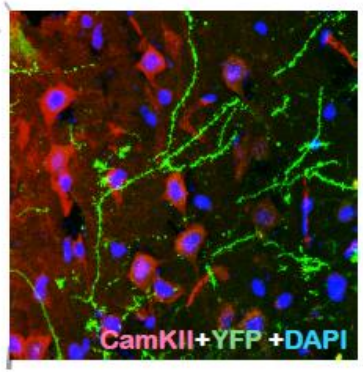
Retrograde tracer in ACC:

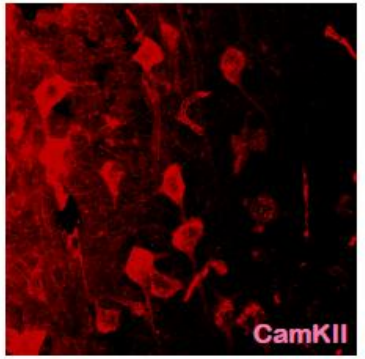


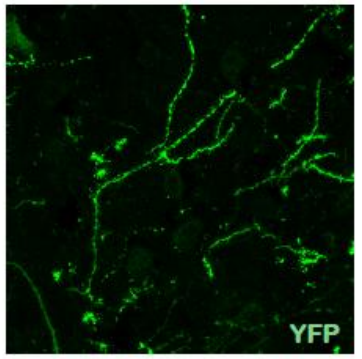


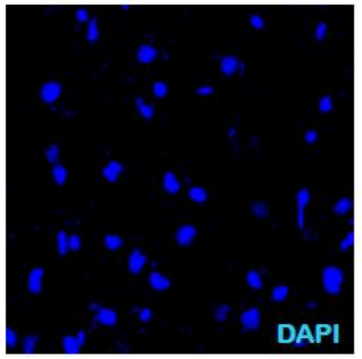
Anterograde tracer in ACC:



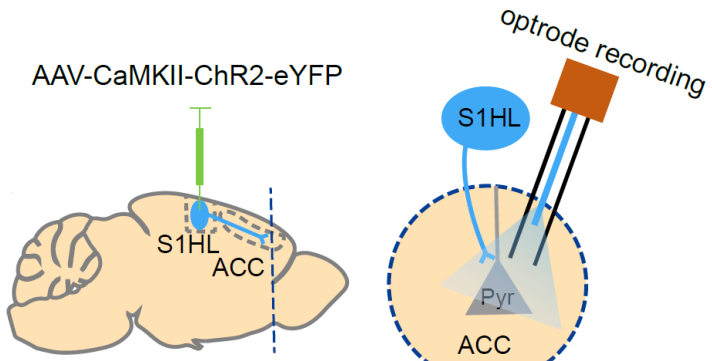


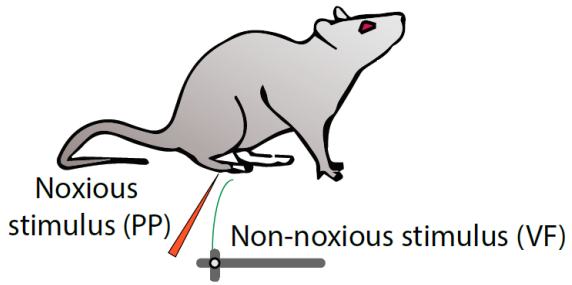


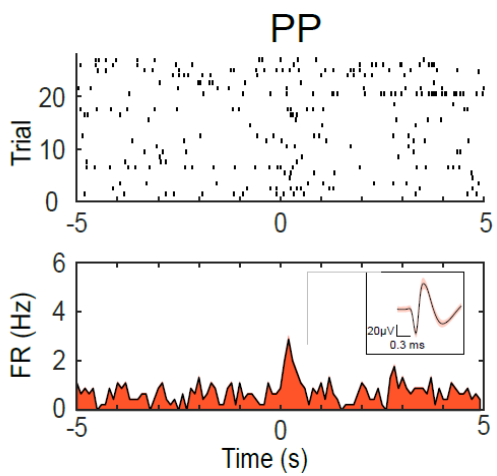


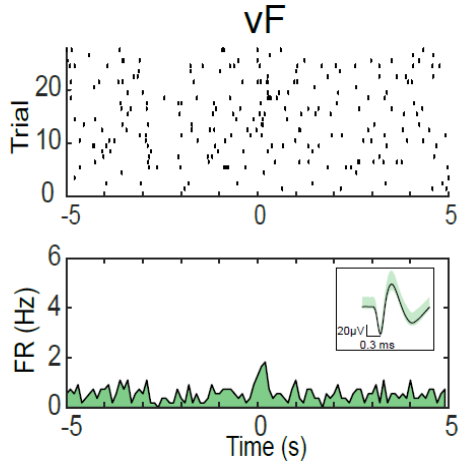


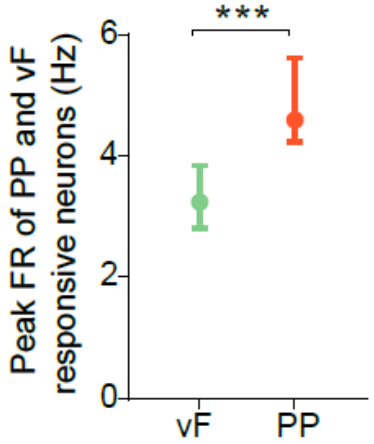
S1 activation selectively enhances nociceptive response in the ACC

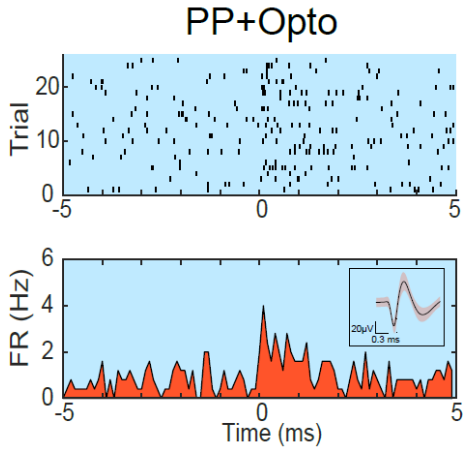


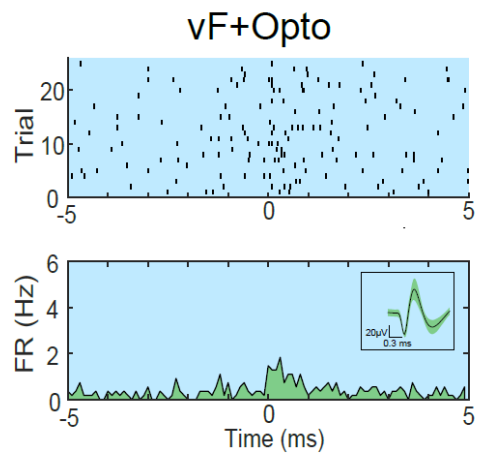


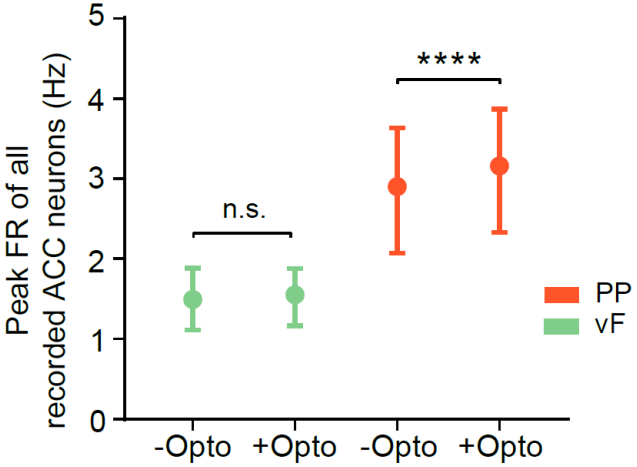




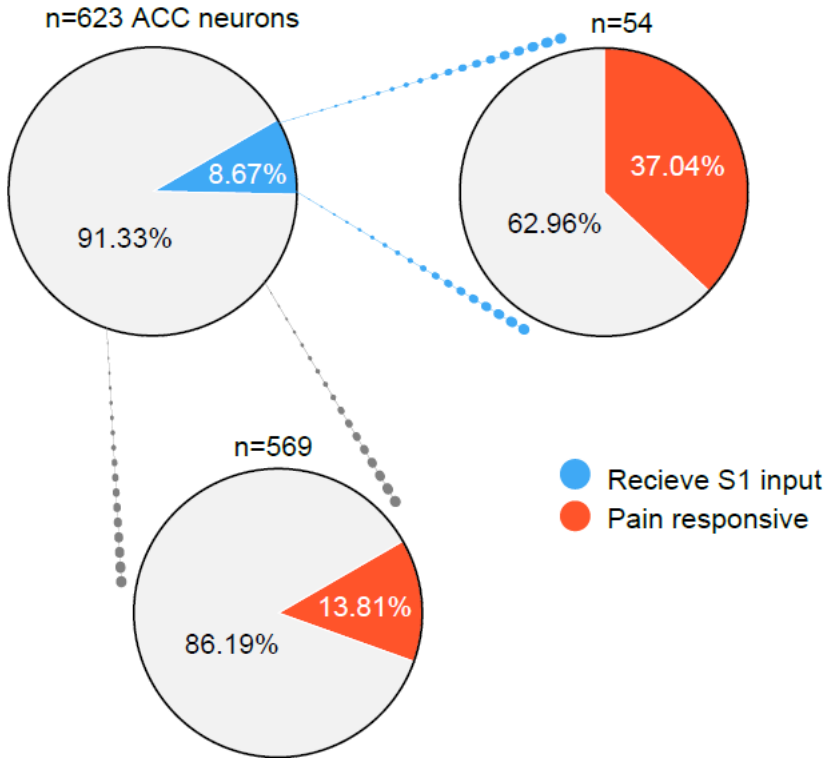


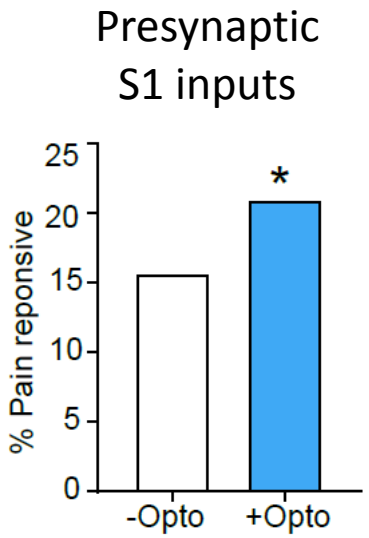


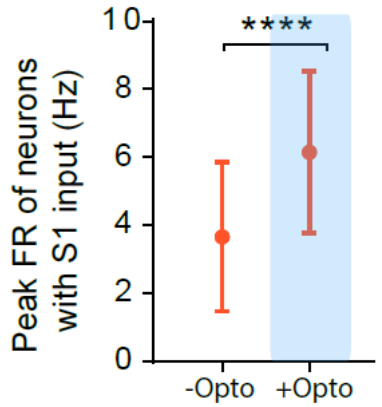


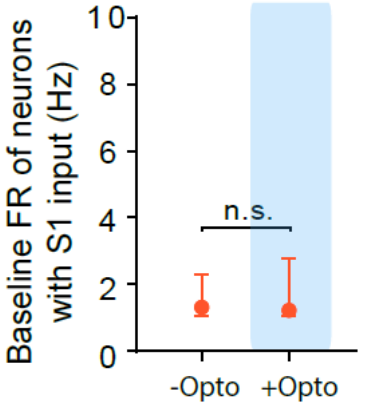


S1 projection recruits ACC neurons to respond to nociceptive inputs and increases firing rates of ACC pain-responsive neurons

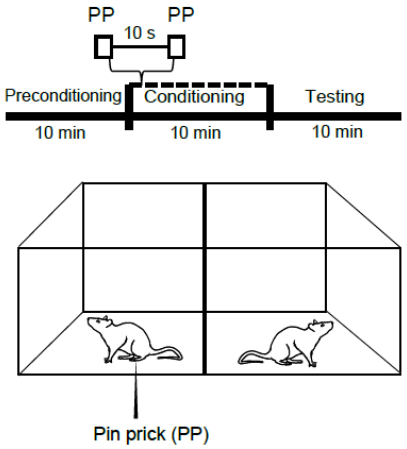


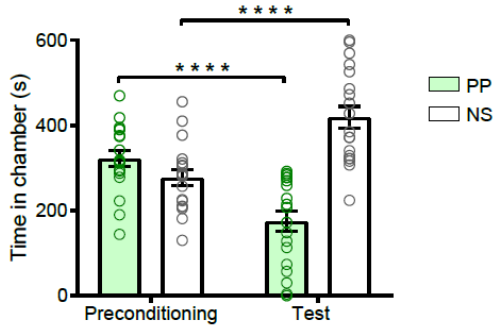


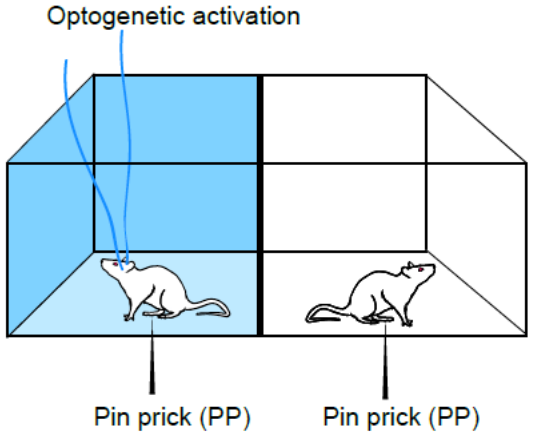


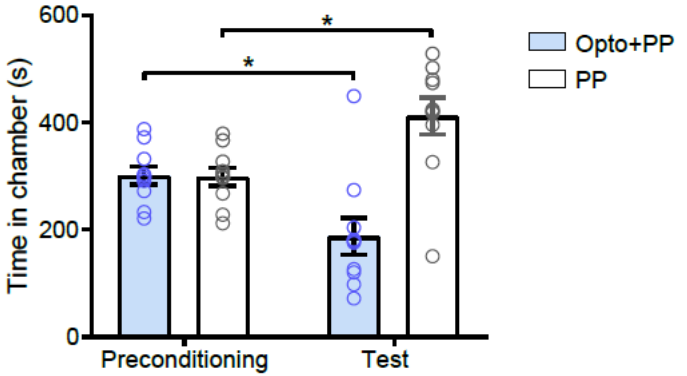


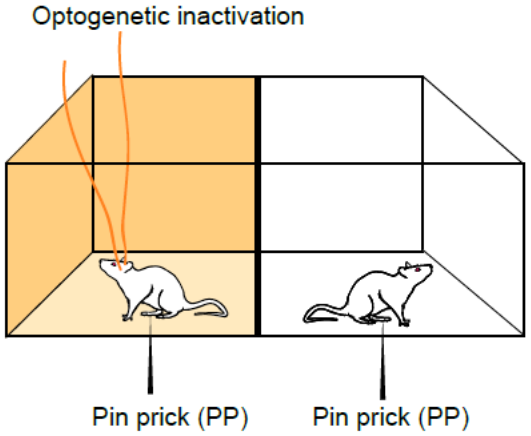
S1 projection to ACC bidirectionally regulates pain aversive response

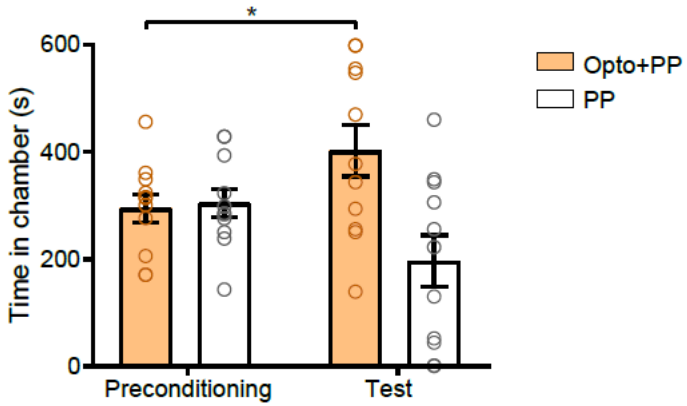




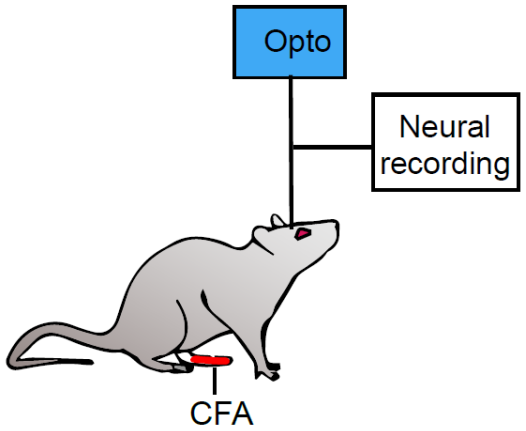


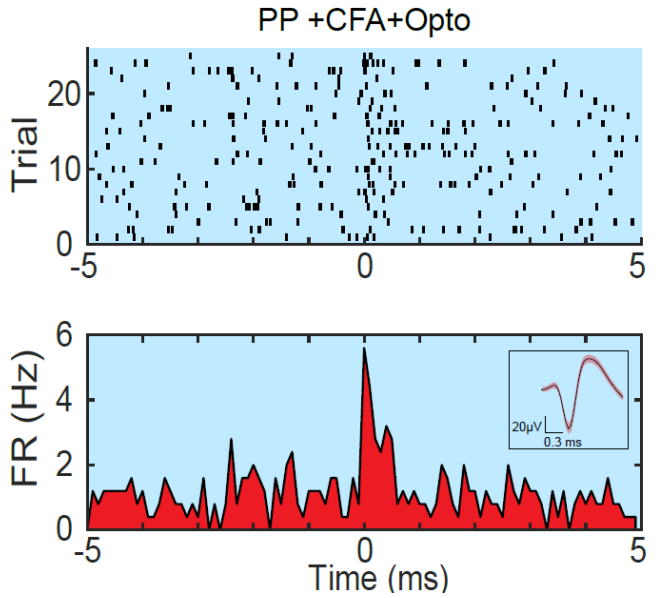


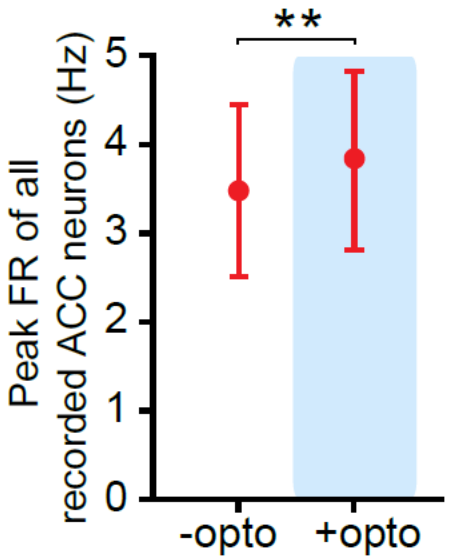


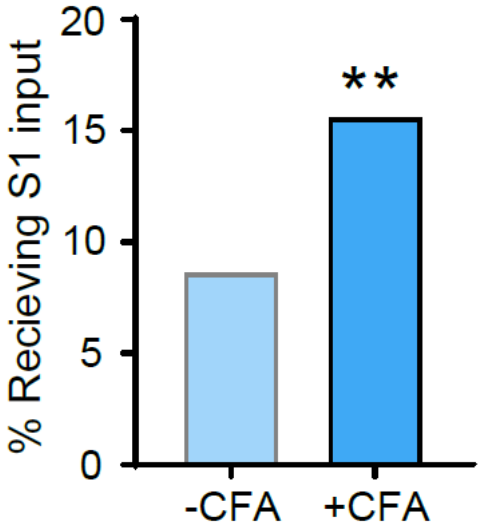


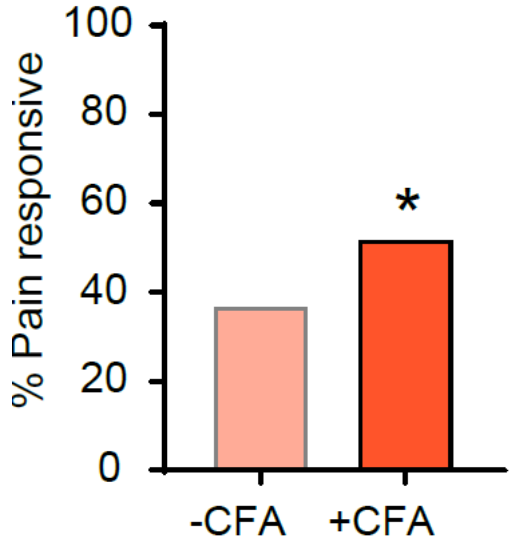
Chronic pain enhances S1 projection to ACC connectivity

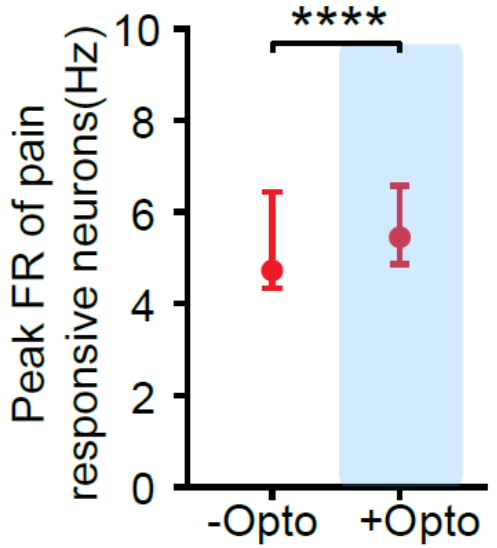




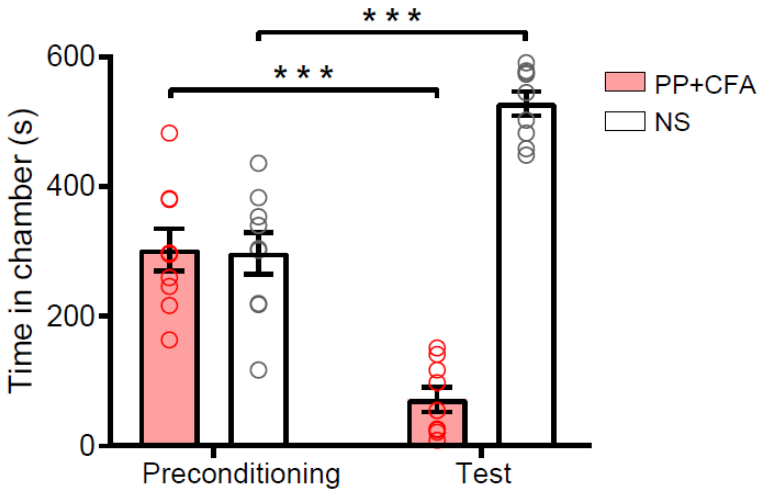


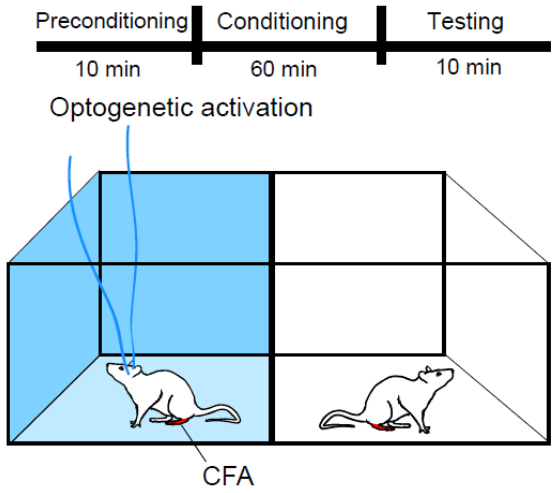


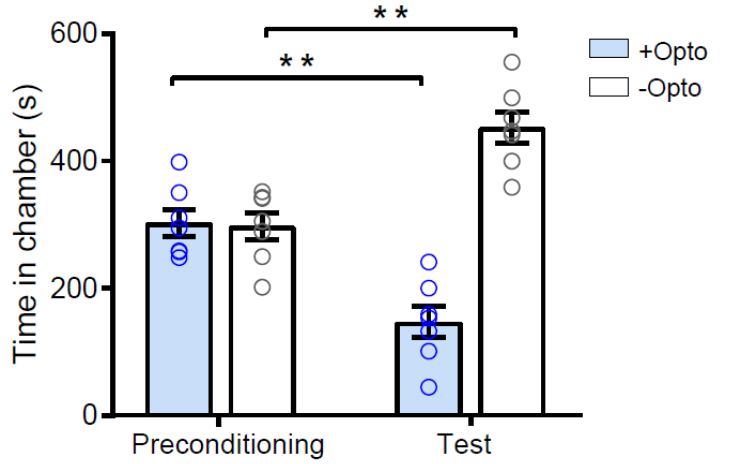


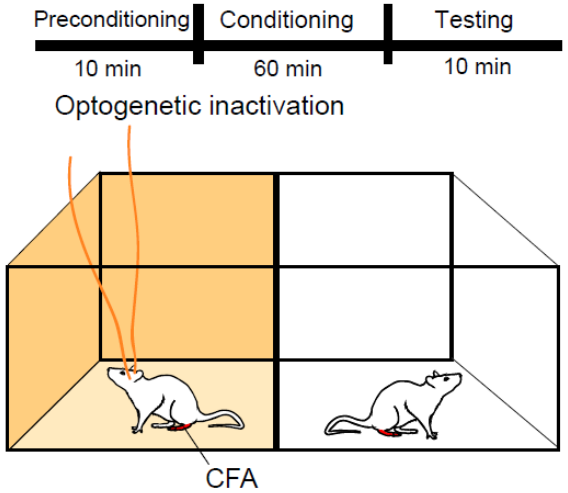


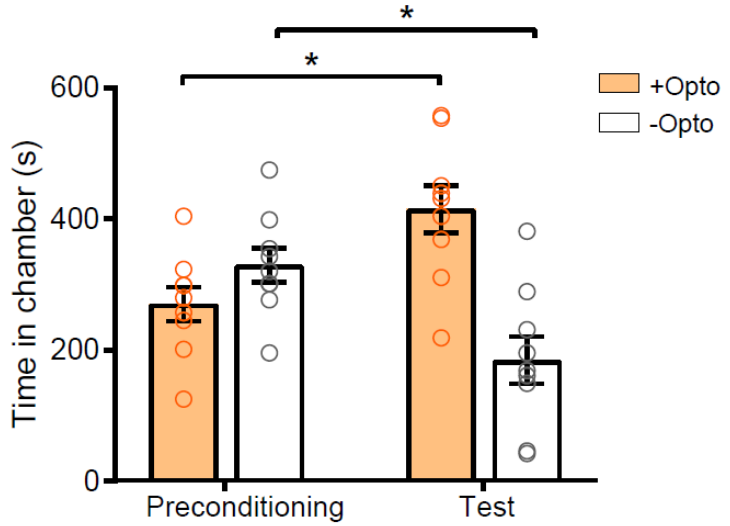
Increased S1 to ACC connectivity in the chronic pain state causes enhanced aversive behavior











Novel circuit for sensory and affective integration

- Direct circuit mechanism for the relay of cortical pain sensory information into higher-order cortical centers to drive appropriate affective responses

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- Amrita Singh
- Divya Patel
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