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Flavia Di Pietro

Tasha R. Stanton

Luke Parkitny

James H. McCauley

Martin Lotze

See next page for additional authors

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Authors

Flavia Di Pietro, Tasha R. Stanton, Luke Parkitny, James H. McCauley, Martin Lotze, Benedict M. Wand, and G Lorimer Moseley

Functional changes in the primary somatosensory cortex in complex regional pain syndrome (CRPS): a systematic review

Flavia Di Pietro, Tasha R Stanton, Luke Parkitny, James H McAuley, Martin Lotze, Benedict M Wand, G Lorimer Moseley

The brain plays a key role in CRPS. A widely-studied brain region in pain research is the primary somatosensory cortex (S1), a somatotopic map of our body's surface which functionally reorganises in pain [1]. Changes in the S1 representation of the CRPS-affected body part have contributed to new CRPS treatments, e.g. graded motor imagery. This systematic review and meta-analysis aimed to determine whether CRPS is associated with:

- a change in the size of the S1 representation of the affected body part;
- altered S1 activity, in terms of activation levels and latency of responses.

METHODS:

We followed the PRISMA guidelines throughout the review process [2]. Studies were included if they investigated S1 function with neuroimaging in adults with CRPS; and compared CRPS S1 function to a control sample (unaffected side or healthy control participant). Only baseline imaging data were extracted. Risk of bias was assessed using an adapted version of the Cochrane risk of bias form and the STROBE statement [3, 4].

RESULTS:

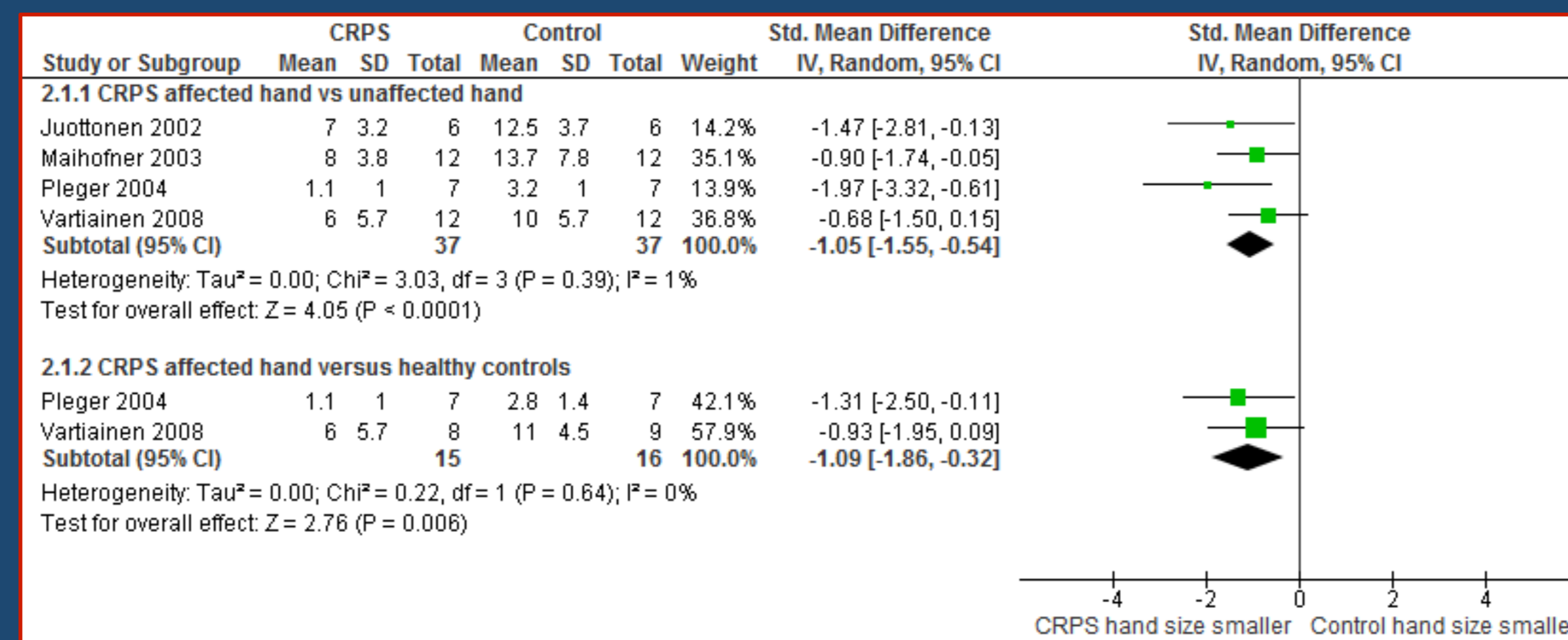
Of the 925 records screened, 13 studies were included. High risk of bias among the studies was mainly due to sampling methods & unblinded assessment of imaging outcomes.

These forest plots demonstrate: smaller S1 representation of the CRPS-affected hand than that in the other hemisphere and in controls; and inconsistent S1 activation levels following stimulation of the CRPS-affected hand.

Findings from fMRI studies into S1 activation were inconsistent. There was no difference in peak latency of S1 responses between sides or groups.

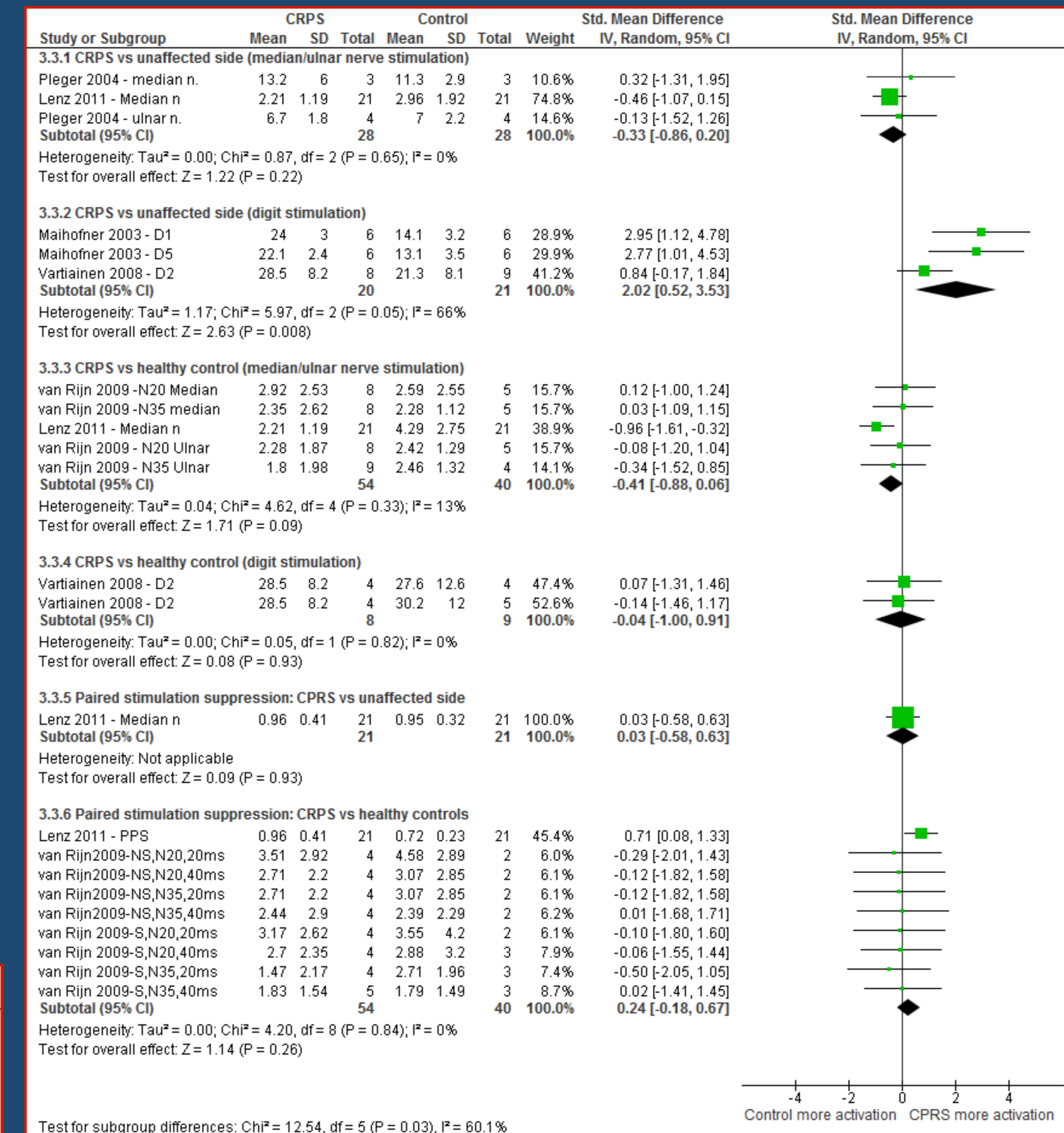
Right: Activation levels in S1 with peripheral stimulation.
Note the two studies of cortical disinhibition with paired stimulation paradigms

Below: Size of hand representation in S1



References:

- [1] Marinus J, et al. Clinical features and pathophysiology of complex regional pain syndrome. *Lancet Neurol.* 2011. 10: 637.
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- [5] Brett M, et al. The problem of functional localization in the human brain. *Nature Rev Neurosci.* 2002. 3: 243.

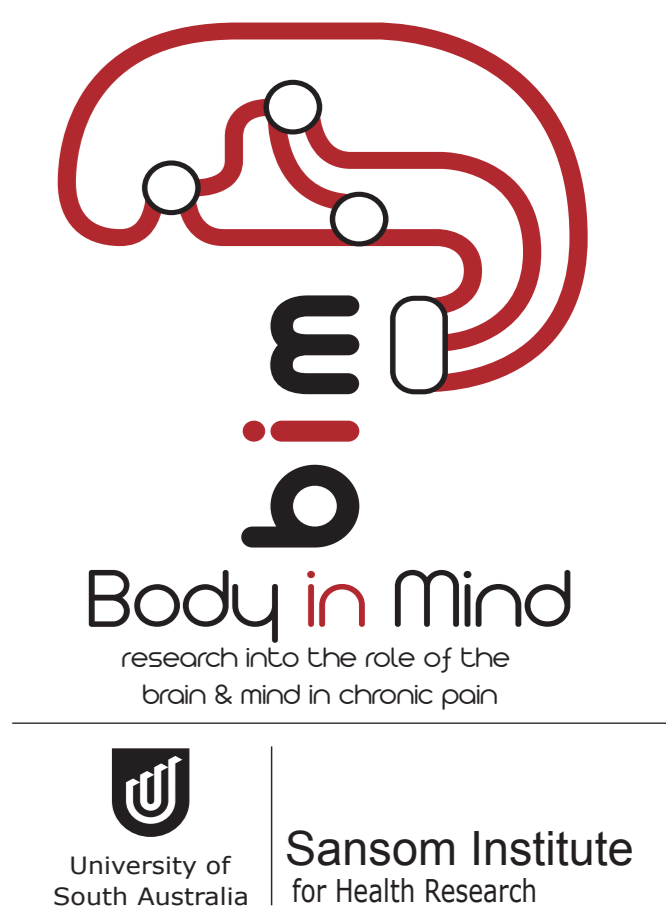


DISCUSSION:

The S1 representation of the affected hand in CRPS is smaller than that of the unaffected hand and the hand representation in controls. We were surprised, in light of widespread endorsement of cortical reorganisation, that only four studies have investigated this and that none of them have used fMRI, which affords the best spatial resolution [5].

Two studies assessed cortical disinhibition in CRPS and had contrasting results. This is an important finding because cortical disinhibition has been considered a key mechanism behind some of the behavioural findings in CRPS and behind the efficacy of some current treatments [1].

Cortically-directed treatments of CRPS have been embraced in research and in the clinic; it would seem crucial that the research into the mechanisms behind these treatments maintains a comparable pace.



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