

The 'disinhibited' brain

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The Complex Regional Pain Syndrome (CRPS), also known as Morbus Sudeck, is characterised by "disinhibition" of various sensory and motor areas in the brain. A multidisciplinary Bochum-based research group, led by Prof. Dr. Martin Tegenthoff (Bergmannsheil Neurology Department) and Prof. Dr. Christoph Maier (Bergmannsheil Department of Pain Therapy), has now demonstrated for the first time that with unilateral CRPS excitability increases not only in the brain area processing the sense of touch of the affected hand. In addition, the brain region representing the healthy hand is simultaneously "disinhibited". The group has been performing research on and treatment of CRPS for a number of years. The researchers are reporting the new findings in the renowned journal *Neurology*.

Is there a predisposition for CRPS?

CRPS can develop after even slight injuries and often leads to long-lasting severe [pain](#), impairment of sensation and movement, as well as changes to the skin and the bones of the affected extremity - in many cases it even causes permanent disability. The precise cause of the syndrome is not known. Alongside inflammatory phenomena, changes in the brain also contribute to the disease becoming chronic. "Although the symptoms are mainly limited to one side of the body, some changes in the brain appear to affect both sides - a finding which could hint at an individual [predisposition](#) for the development of CRPS", says Prof. Martin Tegenthoff.

Faulty programming in the brain

As yet, the origins of the disease remain largely unclear. Pain researchers assume that not only inflammatory factors, but also changes in the central nervous system may be a possible cause. For example, in a number of studies researchers found the representation of the affected hand on the brain's "body map" to have shrunk, a phenomenon closely associated with the patients' [pain intensity](#) and tactile discrimination abilities.

Excitability changes on both sides

In a previous study, the Bochum group already made an astonishing discovery in the motor system of CRPS patients: the excitability of their motor hand area in the brain is increased - not only in the half of the brain controlling the affected side, but also in the half correlating to the healthy side. Following these findings hinting at a systemic disorder of the central [nervous system](#), in the current study the group examined whether bilateral disinhibition can also be found in the brain area processing the [sense of touch](#) (somatosensory cortex). CRPS patients with unilateral symptoms of the hand were examined. After an electrical stimulation, the researchers measured the brain waves in the somatosensory brain area of the affected and the unaffected hand. Results show: the reduction of inhibition which is found on both sides in CRPS is not limited to motor areas. Those areas of the brain that process sensory perception of the hands exhibit distinct changes too.

"Disinhibition": typical of neuropathic pain

The scientists validated these findings by comparing CRPS patients with healthy volunteers and with patients suffering from pain that – in contrast to CRPS – was not caused by a disease of the nerves (so-called non-neuropathic pain). Here too, the researchers found an amazing result: the control patients showed no altered inhibition whatsoever in the

hand area, they did not differ from the healthy volunteers. "This shows that the disinhibition of the brain in CRPS patients appears to be specific for neuropathic pain", says Prof. Tegenthoff.

Systemic changes raise questions

The results indicate that the changes in the [central nervous system](#) caused by CRPS are much more complex than scientists have assumed up to now. Bilateral changes in the central sensorimotor systems that manifest in unilateral symptoms raise questions - for example: are they a cause or a consequence of the disease? The RUB scientists are presently undertaking a first approach at answering this question: in a long-term study they will accompany the patients to perform two further measurements in intervals of six months between dates. In this way, they can relate potential changes in the brain to the healing process. If a successful therapy reverses these changes, they are most probably a consequence of the disease.

Factoring in the brain

"Our research results make clear that changes in the [brain](#) play a prominent role in CRPS", says Prof. Dr. Christoph Maier. "As we already do in current pilot studies performed in the Department of Pain Therapy at Bergmannsheil, future therapies should take this aspect into account, in order to improve the treatment of what continues to be a problematic illness."

More information: Lenz M, Höffken O, Stude P, Lissek S, Schwenkreis P, Reinersmann A, Frettlöh J, Richter H, Tegenthoff M, Maier C.: Bilateral somatosensory cortex disinhibition in complex regional pain syndrome type I. *Neurology*. 2011 Sep 13;77(11):1096-101. Epub 2011 Aug 31.

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