Zentralinstitut für Seelische Gesundheit
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EXZELLENZCLUSTER CellNetworks

DEUTSCHES KREBSFORSCHUNGSZENTRUM IN DER HELMHOLTZ-GEMEINSCHAFT
50 Jahre – Forschen für ein Leben ohne Krebs

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Oxytocin: Double active against pain

An international study, coordinated by Drs Valery Grinevich (German Cancer Research Center, ZI Mannheim, and CellNetworks, Heidelberg), Ron Stoop (Lausanne University) and Alexandre Charlet (CNRS INCI, Strasbourg), has identified a new analgesia-controlling center within the hypothalamus. The center contains about 30 neurons that coordinate the release of oxytocin into the bloodstream and in the central nervous system, all the way to the spinal cord. Their important results are detailed in an article published in *Neuron.*

Oxytocin is a peptide synthesized by the hypothalamus. As a hormone, its release into the blood controls several functions, the most widely known being the contraction of the uterus during birth and the release of maternal milk following birth. Its additional role as a neurotransmitter has been shown by several studies, highlighting oxytocin's involvement in social communication, development of anxiety, stress response and, recently, pain.

The team of Drs. Valery Grinevich, Ron Stoop and Alexandre Charlet had identified a group of about thirty oxytocinergic neurons that act as taskmasters in order to coordinate the global analgesic effect of oxytocin. These neurons are solicited during episodes of acute pain or inflammatory sensitization. Under these conditions, they first activate a family of magnocellular neurons in the neighboring supraoptic nucleus, thus triggering the release of oxytocin into the bloodstream. This leads to a diffuse analgesic effect by reducing the sensory perception of peripheral neurons that relay nociceptive information. Via long-range axons, these neurons reach the deep layers of the spinal cord and secrete oxytocin precisely at the level where the intensity of the nociceptive message is encoded in the central nervous system. Thus, the release of oxytocin acts via a dual pathway: first, it reduces the perception of pain and second, it filters the nociceptive input into the central nervous system.

The results provide evidence for anatomical and functional heterogeneity within the central oxytocin system and offer a new direction for research of mechanisms of coordinated oxytocin regulation of autonomic functions and behavior. Furthermore, from now on, oxytocin can be seen not only as a potential drug for treatment of social deficits in patients with autisms or schizophrenia, but also as a promising therapeutic agent alleviating acute pain.

An illustration is available at:
http://www.dkfz.de/de/presse/pressemitteilungen/2016/bilder/Neuron_cover.jpg

Illustration: Tatiana Glazowa, ©Valery Grinevich

Caption: A revolutionary finding for Oxytocin: Both peripheral and central pathways join in a strategic maneuver to conquer pain

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Althammer, Virginie Chavant, Yannick Goumon, Tim Gruber, Nathalie Petit-Demoulière, Marta Busnelli, Bice Chini, Linette L. Tan, Mariela Mitre, Robert C. Froemke, Moses V. Chao, Günter Giese, Rolf Sprengel, Rohini Kuner, Pierrick Poisbeau, Peter H. Seeburg, Ron Stoop, Alexandre Charlet, and Valery Grinevich: A new population of parvocellular oxytocin neurons controlling magnocellular neuron activity and inflammatory pain processing. NEURON 2016, DOI: 10.1016/j.neuron.2016.01.041

The **German Cancer Research Center** (Deutsches Krebsforschungszentrum, DKFZ) with its more than 3,000 employees is the largest biomedical research institute in Germany. At DKFZ, more than 1,000 scientists investigate how cancer develops, identify cancer risk factors and endeavor to find new strategies to prevent people from getting cancer. They develop novel approaches to make tumor diagnosis more precise and treatment of cancer patients more successful. The staff of the Cancer Information Service (KID) offers information about the widespread disease of cancer for patients, their families, and the general public. Jointly with Heidelberg University Hospital, DKFZ has established the National Center for Tumor Diseases (NCT) Heidelberg, where promising approaches from cancer research are translated into the clinic. In the German Consortium for Translational Cancer Research (DKTK), one of six German Centers for Health Research, DKFZ maintains translational centers at seven university partnering sites. Combining excellent university hospitals with high-profile research at a Helmholtz Center is an important contribution to improving the chances of cancer patients. DKFZ is a member of the Helmholtz Association of National Research Centers, with ninety percent of its funding coming from the German Federal Ministry of Education and Research and the remaining ten percent from the State of Baden-Württemberg.

The **Cluster of Excellence CellNetworks** is an interdisciplinary research association in the molecular life sciences and unites more than 100 internationally leading scientists from six different faculties and five non-university research centers to answer fundamental questions about the network structure, dynamics and regulation of cells with quantitative methods. Founded in 2006 as part of the German Excellence Initiative, the Cluster uses the collaboration in experimental life sciences, technology developments in physics, chemistry and nanotechnology as well as computer sciences and scientific computing to lift this field of research to another level. CellNetwork's research program is divided into four areas ranging from macromolecular building blocks to supracellular networks in the neurosciences. They are complemented by a central technology infrastructure on the highest international level which allows the scientists to evaluate their quantitative analyses.

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