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Protected fear memories

In the latest issue of *Science*, researchers from the Friedrich Miescher Institute for Biomedical Research show how a class of proteins surrounding nerve cells allows fear memories to persist despite extensive fear extinction therapy.

Hands are sweaty, the pulse is running, the mouth is dry. Speaking in front of a large audience is not everybody's most treasured activity. It can be even terrifying. However, practice and some breathing techniques can improve matters. Learning how not to be fearful is possible. Still, all the coping skills cannot guarantee that stage fright doesn't strike again.

A study by the groups of Andreas Lüthi and Pico Caroni from the Friedrich Miescher Institute of Biomedical Research, an institute of the Novartis Research Foundation, sheds a novel light on the question, why fear is almost impossible to get rid of – not even with extensive training. The scientists show in the latest issue of the renowned scientific journal *Science* that a glycoprotein class called chondroitin sulphate proteoglycans (CSPGs) supports the preservation of fear memories.

This protein forms a dense, highly organized extracellular mesh, called perineuronal net (PNN), surrounding nerve cells in the amygdala, the area of the brain controlling fear. In their experiments the scientists could show that the PNN hinders fear extinction. In the presence of the PNN, fear extinction therapy creates new, learned memories of how to deal with a fearful situation. Both, fear and fear extinction memories co-exist and will be called forward depending on the situation. This mechanism explains why a person with stage fright may be coping fine when talking to a smaller group but is speechless in front of a large audience.

In the absence of PNNs, however, fear memories become prone to erasure. Once the scientists degraded the mesh of CSPGs in the amygdala, fear memories were lost. The fear was gone.

The study uncovers a totally novel, molecular mechanism by which fear memories are preserved and protected from erasure. It is highly relevant from a clinical perspective because fear memory extinction is the corner-stone of the psychological therapy of several anxiety disorders. Furthermore, it puts forward a novel explanation for the frequency of relapses of fear responses after extensive therapy, which are a major clinical problem.

Anxiety disorders

The term "anxiety disorder" covers a variety of abnormal and pathological anxieties and fears, including phobias, panic disorders, obsessive compulsive disorders and post-traumatic stress disorders. The current course of therapy includes both cognitive behavioral therapy as well as pharmaceutical therapy. In anxiety treatment, cognitive behavioral therapy exposes the patient gradually to the feared stimulus. Through this exposure, patients unlearn their fear reactions. Almost every fifth person in the United States has been reported with an anxiety disorder in a recent study.

Original publications



Gaugolla N et al. (2009) [Perineuronal nets protect fear memories from erasure](#). Science, 325: 1258 - 1261

-> [Online Publication](#)

Further information

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About the FMI

The Friedrich Miescher Institute for Biomedical Research (FMI), based in Basel, Switzerland, is a world-class center for basic research in life sciences. It was founded in 1970 as a joint effort of two Basel-based pharmaceutical companies and is now part of **the Novartis Research Foundation**. The FMI is devoted to the pursuit of fundamental biomedical research. Areas of expertise are neurobiology, growth control, which includes signaling pathways, and the epigenetics of stem cell development and cell differentiation. The institute counts 320 collaborators. The FMI also offers training in biomedical research to PhD students and postdoctoral fellows from around the world. In addition the FMI is affiliated with the University of Basel. The Director of the FMI since 2004 is Prof. Susan Gasser.