

# Protecting Your Brain From Disaster

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## **Stress is hard on your brain.**

**But you can learn simple steps to protect your brain after stress.**

**What this PDF will show you:**

- **How severe stress can adversely effect your brain two years down the road.**
- **What you can do to protect your brain and the science behind it.**
- **Brain disaster protectors: oxytocin, zinc, omega-3 fatty acids, and Lion's mane mushroom.**

**Stress Evaluation shows negative effects from stress last up to two years, long after the stressful events themselves have stopped and your anxiety levels seem to be okay. For example, The Holmes-Rahe Stress Inventory tracks various stressful events that occurred in your life in the last two years, to see how stress may be playing a role in your present personal health issues,**

**especially cognition and mood** (<https://www.stress.org/holmes-rahe-stress-inventory>).

*Here is a compilation of some pertinent, fascinating and very helpful scientific studies, to help you protect your brain from disaster.*

Two years' after severe stress, your brain still may not be functioning optimally. You may feel not quite "right" but not know why. This study's title tells it all. This study on earthquake victims, whose brain health was tracked by MRIs, shows what can happen long-term to your brain after stress unless you take protective actions.

**Severe stress can alter your brain's functional connectivity for up to 2 years after the stress occurred.**

**Altered functional connectivity in the brain default-mode network of earthquake survivors persists after 2 years despite recovery from anxiety symptoms.** (Soc Cogn Affect Neurosci. 2015 Nov;10(11):1497-505).

*Study summary shows that brain "connectivity" is still not working optimally after two years, even when anxiety levels are back to normal. These brain studies were performed on earthquake victims.*

Although acute impact of traumatic experiences on brain function in disaster survivors is similar to that observed in post-traumatic stress disorders (PTSD), little is known about the long-term impact of this experience. We have used structural and functional magnetic resonance imaging to investigate resting-state functional connectivity and gray and white matter (WM) changes occurring in the brains of healthy Wenchuan earthquake survivors both 3 weeks and 2 years after the disaster. *Results show that while functional connectivity changes 3 weeks after the disaster involved both frontal-limbic-striatal and default-mode networks (DMN), at the 2-year follow-up only changes in the latter persisted, despite complete recovery from high initial levels of anxiety.* No gray or WM volume changes were found at either time point. Taken together, our findings provide important new evidence that while altered functional connectivity in the frontal-limbic-striatal network may underlie the post-trauma anxiety experienced by survivors, parallel changes in the DMN persist despite the apparent absence of anxiety symptoms. This suggests that long-term changes occur in neural networks involved in core aspects of self-processing, cognitive and emotional functioning in disaster survivors, which are independent of anxiety symptoms, and which may also confer increased risk of subsequent development of PTSD.

***How to fix brain connectivity issues? Oxytocin nasal spray therapy.***

**Oxytocin, brain physiology, and functional connectivity: a review of intranasal oxytocin fMRI studies.** Psychoneuroendocrinology. 2013 Jul;38(7):962-74..

In recent years the neuropeptide oxytocin (OT) has become one of the most studied peptides of the human neuroendocrine system. Research has shown widespread behavioral effects and numerous potential therapeutic benefits. However, little is known about how OT triggers these effects in the brain. Here, we discuss some of the physiological properties of OT in the human brain including the long half-life of neuropeptides, the diffuse projections of OT throughout the brain and interactions with other systems such as the dopaminergic system. These properties indicate that OT acts without clear spatial and temporal specificity. Therefore, it is likely to have widespread effects on the brain's intrinsic functioning.

Additionally, we review studies that have used functional magnetic resonance imaging (fMRI) concurrently with OT administration. These studies reveal a specific set of 'social' brain regions that are likely to be the strongest targets for OT's potential to influence human behavior. On the basis of the fMRI literature and the physiological properties of the neuropeptide, we argue that OT has the potential to not only modulate activity in a set of specific brain regions, but also the functional connectivity between these regions. In light of the increasing knowledge of the behavioral effects of OT in humans, studies of the effects of OT administration on brain function can contribute to our understanding of the neural networks in the social brain.

**Intranasal Oxytocin Selectively Modulates Large-Scale Brain Networks in Humans.**  
Brain Connect. 2017 Sep;7(7):454-463.

*Study Summary:*

A growing body of evidence indicates that the neuropeptide oxytocin (OT) alters the neural correlates of socio-emotional and salience processing. Yet the effects of OT over important large-scale networks involved in these processes, such as the default mode (DM), ventral attention (VA), and cingulo-opercular (CO) networks, remain unknown. Therefore, we conducted a placebo-controlled crossover study with intranasal 24 IU OT in 38 healthy male subjects using a resting-state functional magnetic resonance imaging paradigm to investigate its impact over these three networks candidates. To understand the underlying mechanisms of the neuropeptide, we compared the intra-network connectivity for each network candidate and also the internetwork connectivity across all networks between both treatment conditions. Based on the relevance of inter-individual factors for OT effects, we correlated individual network changes with behavioral performance in a decision-making task and with impulsivity scores.

Our results show that OT mainly alters connectivity in the VA, on one side reducing the coupling to regions that typically form the nodes of DM, an introspective and self-referential network, and on the other side increasing the coupling to the edges of the CO, which is involved in salience processing. The results of the internetwork

analyses confirmed the specificity of the OT effects. Indeed, we observed significant correlations with the erroneous performance during decision-making but not with the obtained impulsivity scores. **Overall, our data support that the modulation of functional connectivity within the VA is a basic mechanism by which OT directs attentional resources from internal to external cues, preparing the brain for context-dependent salience processing.**

## Oxytocin actually reduces posttraumatic stress disorder!

**Intranasal oxytocin reduces provoked symptoms in female patients with posttraumatic stress disorder despite exerting sympathomimetic and positive chronotropic effects in a randomized controlled trial.** BMC Med. 2017 Feb 17;15(1):40.

### *Study Summary:*

Posttraumatic stress disorder (PTSD) is a severe psychiatric disease accompanied by neuroendocrine changes such as adrenergic overdrive and hence an elevated cardiovascular morbidity. Current pharmacotherapeutic options for PTSD are less than suboptimal. To evaluate for the first time how oxytocin influences the intensity of provoked PTSD symptoms and, furthermore, cardiac control in female PTSD patients, we assessed their psychic and cardiac response to trauma-script exposure with and without oxytocin pretreatment in a double-blind randomized placebo-controlled study. We used a within-subject design to study 35 female PTSD patients who received oxytocin and placebo in a 2-week interval. Furthermore, we performed a small pilot study to get an idea of the relation of the stress-modulated endogenous oxytocin levels and heart rate - we correlated oxytocin serum levels with the heart rate of 10 healthy individuals before and after exposure to the Trier Social Stress Test (TSST).

**Results:** Intranasal oxytocin treatment was followed by a reduction of provoked total PTSD symptoms, in particular of avoidance, and by an elevation in baseline and maximum heart rate together with a drop in the pre-ejection period, a marker for sympathetic cardiac control. Furthermore, we found a positive correlation between endogenous oxytocin levels and heart rate both before and after TSST challenge in healthy control subjects.

**Conclusions:** This study provides the first evidence that oxytocin treatment reduces the intensity of provoked PTSD symptoms in female PTSD patients.

**Efficacy of oxytocin administration early after psychotrauma in preventing the development of PTSD: study protocol of a randomized controlled trial.** BMC Psychiatry. 2014 Mar 28;14:92.

### *Study Summary:*

Currently few evidence based interventions are available for the prevention of PTSD within the first weeks after trauma. Increased risk for PTSD development is associated with dysregulated fear and stress responses prior to and shortly after trauma, as well as with a lack of perceived social support early after trauma. Oxytocin is a potent regulator of these processes. Therefore, we propose that oxytocin may be important in reducing adverse consequences of trauma. The 'BONDS' study is conducted in order to assess the efficacy of an early intervention with intranasal oxytocin for the prevention of PTSD.

In this multicenter double-blind randomized placebo-controlled trial we will recruit 220 Emergency Department patients at increased risk of PTSD. Trauma-exposed patients are screened for increased PTSD risk with questionnaires assessing peri-traumatic distress and acute PTSD symptoms within 7 days after trauma. Baseline PTSD symptom severity scores and neuroendocrine and psychophysiological measures will be collected within 10 days after trauma. Participants will be randomized to 7.5 days of intranasal oxytocin (40 IU) or placebo twice a day. Follow-up measurements at 1.5, 3 and 6 months post-trauma are collected to assess PTSD symptom severity (the primary outcome measure). Other measures of symptoms of psychopathology, and neuroendocrine and psychophysiological disorders are secondary outcome measures.

**Conclusion:** We hypothesize that intranasal oxytocin administered early after trauma is an effective pharmacological strategy to prevent PTSD in individuals at increased risk, which is both safe and easily applicable.

### **Zinc reduces stressful memories!**

*Zinc supplementation (in an animal model that appears to be relevant for humans) reduces memory recall in the hippocampus, making stress easier to 'live with' in the long run! The power of nutrition!*

### **Zinc supplementation in rats impairs hippocampal-dependent memory consolidation and dampens post-traumatic recollection of stressful event.**

#### *Study Summary:*

Zinc is a trace element important for synaptic plasticity, learning and memory. Zinc deficiency, both during pregnancy and after birth, impairs cognitive performance and, in addition to memory deficits, also results in alterations of attention, activity, neuropsychological behavior and motor development. The effects of zinc supplementation on cognition, particularly in the adult, are less clear. We demonstrate here in adult rats, that 4 week-long zinc supplementation given by drinking water, and approximately doubling normal daily intake, strongly impairs consolidation of hippocampal-dependent memory, tested through contextual fear

conditioning and inhibitory avoidance. Furthermore, the same treatment started after memory consolidation of training for the same behavioral tests, substantially dampens the recall of the stressful event occurred 4 weeks before. **A molecular correlate of the amnesic effect of zinc supplementation** is represented by a dysregulated function of GSK-3 $\beta$  in the hippocampus, a kinase that participates in memory processes. **The possible relevance of these data for humans**, in particular regarding post-traumatic stress disorders, is discussed in view of future investigation.

### ***Nutrients protect the brain from stress and mood dysregulation!***

**The Role of Nutrients in Protecting Mitochondrial Function and Neurotransmitter Signaling: Implications for the Treatment of Depression, PTSD, and Suicidal Behaviors.** Crit Rev Food Sci Nutr. 2016 Nov 17;56(15):2560-2578.

#### *Study Summary:*

Numerous studies have linked severe stress to the development of major depressive disorder (MDD) and suicidal behaviors. Furthermore, recent preclinical studies from our laboratory and others have demonstrated that in rodents, chronic stress and the stress hormone cortisol cause oxidative damage to mitochondrial function and membrane lipids in the brain. Mitochondria play a key role in synaptic neurotransmitter signaling by providing adenosine triphosphate (ATP), mediating lipid and protein synthesis, buffering intracellular calcium, and regulating apoptotic and resilience pathways. Membrane lipids are similarly essential to central nervous system (CNS) function because cholesterol, polyunsaturated fatty acids, and sphingolipids form a lipid raft region, a special lipid region on the membrane that mediates neurotransmitter signaling through G-protein-coupled receptors and ion channels. Low serum cholesterol levels, low antioxidant capacity, and abnormal early morning cortisol levels are biomarkers consistently associated with both depression and suicidal behaviors. In this review, we summarize the manner in which nutrients can protect against oxidative damage to mitochondria and lipids in the neuronal circuits associated with cognitive and affective behaviors. **These nutrients include  $\omega$ 3 fatty acids, antioxidants (vitamin C and zinc), members of the vitamin B family (Vitamin B12 and folic acid), and magnesium (the same nutrients by the way that support oxytocin's protective effects on the brain)!**

Accumulating data have shown that these nutrients can enhance neurocognitive function, and may have therapeutic benefits for depression and suicidal behaviors. A growing body of studies suggests the intriguing possibility that regular consumption of these nutrients may help prevent the onset of mood disorders and suicidal behaviors in vulnerable individuals, or significantly augment the therapeutic effect of available antidepressants. These findings have important implications for the health of both military and civilian populations.

*Fish oil reduces PTSD.*

**Change in blood levels of eicosapentaenoic acid and posttraumatic stress symptom: A secondary analysis of data from a placebo-controlled trial of omega3 supplements.**

J Affect Disord. 2016 Nov 15;205:289-291.

*Study summary:*

Eicosapentaenoic acid (EPA) is suggested to be protective against posttraumatic stress disorder (PTSD) from two observational studies. We previously conducted a randomized controlled trial and found no effect of docosahexaenoic acid (DHA) for prevention of PTSD.

The percentages of EPA, DHA, and arachidonic acid (AA) were measured in erythrocyte (red blood cell) membranes at baseline and post-treatment in 110 participants with severe physical injury who were randomly assigned to receive either a daily dose of 1,470mg DHA and 147mg EPA or of placebo for 12 weeks. Associations between change in erythrocyte fatty acid levels during the trial controlling for each baseline level and PTSD severity at 12 weeks were analyzed by treatment arm.

*Results:*

In the omega3 supplements arm, the more EPA+DHA levels in red blood cells, the less PTSD severity.

*Conclusions:*

**Increased erythrocyte level of EPA during the trial was associated with low severity of PTSD symptoms in patients receiving omega3 supplements.**

**Lion's Mane Mushroom protects your brain (and gut) from adverse effects of stress!**

Mushrooms protect the brain. A large Japanese study (on a little over 13,000 persons) showed that the more you eat mushrooms, the better your brain and cognition. This is especially true for one particular mushroom with the popular name of Lion's Mane, because the shape of the mushroom looks like a lion's mane.

Mushrooms are so brain protective they should be regarded as functional foods for the mitigation of neurodegenerative diseases. They can help protect the brain against nasty long term effects from diverse disasters, and they even protect the gut from stress, too. Mushrooms, like Lion's Mane, are one of a disaster victim's best friend.



Evid Based Complement Alternat Med. 2017;2017:3864340. Dietary Supplementation of - Hericium erinaceus -Increases Mossy Fiber-CA3 Hippocampal Neurotransmission and Recognition Memory in Wild-Type Mice.

J Am Geriatr Soc. 2017 Jul;65(7):1462-1469. Mar 13. Mushroom Consumption and Incident Dementia in Elderly Japanese: The Ohsaki Cohort 2006 Study.

Edible and Medicinal Mushrooms: Emerging Brain Food for the Mitigation of Neurodegenerative Diseases(<http://online.liebertpub.com/doi/full/10.1089/jmf.2016.3740>),

Hericenone C, D and E, stimulators of nerve growth factor (NGF) synthesis from the mushroom Hericium erinaceum. Tetrahedron Lett 32, 4561-4564.

Hericenones and erinacines: stimulators of nerve growth factor (NGF) biosynthesis in Hericium erinaceus. Mycology: An International Journal on Fungal Biology. 1(2): 92-98.

Improving effects of the mushroom Yamabushitake (Hericium erinaceus) on mild cognitive impairment: a double blinded, placebo controlled clinical trial. Phytother Res. 23:367-372.

Effects of Hericium erinaceus on amyloid  $\beta$ (25-35) peptide-induced learning and memory deficits in mice. Biomed Res. 32(1):67-72.

Reduction of depression and anxiety by 4 weeks Hericium erinaceus intake. Biomed Res. 31(4):231-7.

Notes on nutritional properties of culinary-medicinal mushrooms. International Journal of Medicinal Mushrooms. 2005; 7:109-116.

The role of biomarkers in clinical trials for Alzheimer disease. 20(1):6-15.

***Surgery can be stressful on the brain, too.***

Surgery, especially when done under general anesthesia, performed in conjunction with a serious diagnosis, and/or when done in people over 65 years old, can be brain stressful. So consider all of the above brain protectors when going through surgeries under these conditions.

[PLoS One](#). 2015 Nov 4;10(11):e0140655. Postoperative Structural Brain Changes and Cognitive Dysfunction in Patients with Breast Cancer.

*Study summary:*



Our findings suggest that surgery after stressful diagnoses may be associated with alterations in brain structure, particularly in the thalamus, and promote cognitive dysfunction.