Lithium and the Brain article

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**Lithium in the brain**

***Date:***

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***Source:***

Technische Universitaet Muenchen

***Summary:***

Experiments with neutrons show that the antidepressant lithium accumulates more strongly in white matter of the brain than in grey matter. This leads to the conclusion that it works differently from synthetic psychotropic drugs. Brain tissue samples were examined in one study with the aim of developing a better understanding of the effects this substance has on the human psyche.

At present lithium is most popular for its use in rechargeable batteries. But for decades now, lithium has also been used to treat various psychological diseases such as depressions, manias and bipolar disorders. But, the exact biological mode of action in certain brain regions has hardly been understood. It is well known that lithium lightens moods and reduces aggression potential.

Because it is so hard to dose, doctors have been reluctant to prescribe this "universal drug." Nonetheless, a number of international studies have shown that a higher natural lithium content in drinking water leads to a lower suicide rate in the general population. Lithium accumulates in the brains of untreated people, too. This means that lithium, which has so far been regarded as unimportant, could be an essential trace element for humans.

This is what Josef Lichtinger is studying in his doctoral thesis at the Chair for Hadron and Nuclear Physics (E12) at the Technische Universität München. From the Institute for Forensic Medicine at the Ludwig-Maximilians-Universität Munich (LMU) he received tissue samples taken from patients treated with lithium, untreated patients and healthy test persons. The physicist exposed these to a focused cold neutron beam of greatest intensity at the measuring station for prompt gamma activation analysis at FRM II.

Lithium reacts with neutrons in a very specific manner and decays to a helium and a tritium atom. Using a special detector developed by Josef Lichtinger, traces as low as 0.45 nanograms of lithium per gram of tissue can be measured. "It is impossible to make measurements as precise as those using the neutrons with any other method," says Jutta Schöpfer, forensic scientist at the LMU in charge of several research projects on lithium distribution in the human body.

Lichtinger's results are surprising: Only in the samples of a depressive patient treated with lithium did he observe a higher accumulation of lithium in the so-called white matter. This is the area in the brain where nerve tracts run. The lithium content in the neighboring grey matter was 3 to 4 times lower. Lithium accumulation in white matter was not observed in a number of untreated depressive patients. This points to the fact that lithium does not work in the space between nerve cells, like other psychotropic drugs, but within the nerve tracts themselves.

In a next step Josef Lichtinger plans to examine further tissue samples at TUM's Research Neutron Source in order to confirm and expand his results. The goal is a space-resolved map showing lithium accumulation in the brain of a healthy and a depressive patient. This would allow the universal drug lithium to be prescribed for psychological disorders with greater precision and control.

**Story Source:**

The above story is based on [materials](http://www.tum.de/en/about-tum/news/press-releases/short/article/31053/" \t "_blank) provided by **[Technische Universitaet Muenchen](http://www.tum.de/" \t "_blank)**. *Note: Materials may be edited for content and length.*

Source: Princeton.edu

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| **Lithium carbonate** |

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| |  | | --- | |  | | **related topics** | | {acid, form, water} | | {disease, patient, cell} | | {system, computer, user} | | |  | | --- | | 723 °C  1310 °C decomp.  **Lithium carbonate** is a [chemical compound](http://www.wikipedia.org/wiki/Chemical_compound) of[lithium](http://www.wikipedia.org/wiki/Lithium), [carbon](http://www.wikipedia.org/wiki/Carbon), and [oxygen](http://www.wikipedia.org/wiki/Oxygen) with the [formula](http://www.wikipedia.org/wiki/Chemical_formula) Li2CO3. This colorless [salt](http://www.wikipedia.org/wiki/Salt_(chemistry)) is widely used in the processing of metal oxides and has received attention for its use in [psychiatry](http://www.wikipedia.org/wiki/Psychiatry). It is found in nature as the rare mineral [zabuyelite](http://www.wikipedia.org/wiki/Zabuyelite" \o "Zabuyelite).[[2]](http://en.wikipedia.org/wiki/Lithium_carbonate#cite_note-webmineral.com-1)  ***Contents***   * [1 Properties](http://en.wikipedia.org/wiki/Lithium_carbonate#Properties) * [2 Applications](http://en.wikipedia.org/wiki/Lithium_carbonate#Applications)   + [2.1 Medical uses](http://en.wikipedia.org/wiki/Lithium_carbonate#Medical_uses)   + [2.2 Pyrotechnics](http://en.wikipedia.org/wiki/Lithium_carbonate#Pyrotechnics) * [3 References](http://en.wikipedia.org/wiki/Lithium_carbonate#References) * [4 For more information](http://en.wikipedia.org/wiki/Lithium_carbonate#For_more_information)   **Properties**  Like almost all other lithium compounds, Li2CO3 is polymeric. It is relatively [covalent](http://www.wikipedia.org/wiki/Covalent) and this is shown by its small solubility. The isolation of lithium from aqueous extracts of its ores capitalizes on this low solubility. Its apparent solubility increases tenfold under a mild pressure of [carbon dioxide](http://www.wikipedia.org/wiki/Carbon_dioxide); this effect is due to the formation of the [metastable](http://www.wikipedia.org/wiki/Metastability" \o "Metastability)[bicarbonate](http://www.wikipedia.org/wiki/Bicarbonate):  **Applications**  Lithium carbonate is an important industrial chemical. It forms low-melting [fluxes](http://www.wikipedia.org/wiki/Flux_(metallurgy)) with silica and other materials. Glasses derived from lithium carbonate are useful in ovenware. Lithium carbonate is a common ingredient in both low-fire and high-fire ceramic glaze. Its alkaline properties are conducive to changing the state of metal oxide colorants in glaze particularly red iron oxide (FeO3). Cement sets more rapidly when prepared with lithium carbonate, and is useful for tile adhesives. When added to[aluminium trifluoride](http://www.wikipedia.org/wiki/Aluminium_trifluoride), it forms LiF which gives a superior [electrolyte](http://www.wikipedia.org/wiki/Electrolyte) for the processing of [aluminium](http://www.wikipedia.org/wiki/Aluminium" \o "Aluminium).[[3]](http://en.wikipedia.org/wiki/Lithium_carbonate#cite_note-Ullmann-2) Lithium carbonate is used as an active material of[carbon dioxide sensors](http://www.wikipedia.org/wiki/Carbon_dioxide_sensor).[[4]](http://en.wikipedia.org/wiki/Lithium_carbonate#cite_note-3) It is also used in the manufacture of most [lithium-ion battery](http://www.wikipedia.org/wiki/Lithium-ion_battery) cathodes, which are made of [lithium cobalt oxide](http://www.wikipedia.org/wiki/Lithium_cobalt_oxide).  **Medical uses**  Lithium carbonate is used to treat [mania](http://www.wikipedia.org/wiki/Mania), the up phase of [bipolar disorder](http://www.wikipedia.org/wiki/Bipolar_disorder). Lithium ions interfere with chemical reactions ([sodium pump](http://www.wikipedia.org/wiki/Sodium_pump)) that relay and amplify messages carried to the cells of the brain.[[5]](http://en.wikipedia.org/wiki/Lithium_carbonate#cite_note-4)In mania there is an observed irregular increase in protein kinase C (PKC) activity within the brain. A recent study has shown that lithium carbonate and sodium valproate, another drug traditionally used to treat the disorder, act in the brain by inhibiting PKC’s activity and help to create other compounds that also inhibit the PKC. Lithium carbonate is of little use for someone suffering from unipolar depression.[[6]](http://en.wikipedia.org/wiki/Lithium_carbonate#cite_note-5) | |