

# Taurine participates in E/I balance during whisker stimulation: <sup>1</sup>H-MRS in awake mice

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## Introduction

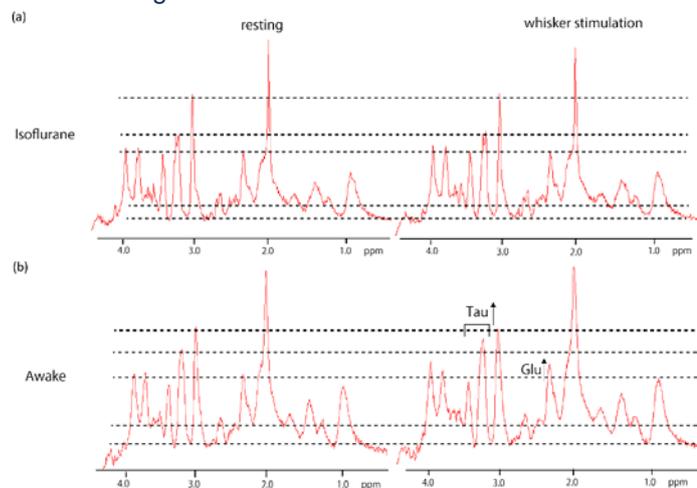
Despite being considered a major osmolyte, taurine (Taur) exhibits functions that go beyond osmoregulation. A number of previous studies *in vitro* have reported that Taur plays an inhibitory role in the excitation and inhibition (E/I) balance. However, it remains unclear how Taur participates in the E/I balance *in vivo*. Therefore, to investigate the dynamics of Taur along with other neurochemicals, such as glutamate (Glu) and gamma-aminobutyric acid (GABA), during neural activity, proton magnetic resonance spectroscopy (<sup>1</sup>H-MRS) was performed within the somatosensory area of the mouse brain with whisker stimulation under awake and general anesthesia.

## Methods

The present study utilized C57BL/6J and Taur transporter knockout (TaurT KO) mice<sup>1</sup>. Magnetic resonance imaging (MRI) and <sup>1</sup>H-MRS were performed on a 7.0 T MRI scanner (Bruker, Germany) with a volume coil for transmission and a two-channel phased-array cooled surface coil for reception. For awake mice experiments, isoflurane was used only for a few minutes during the initial phase of the experiments. Localized <sup>1</sup>H-MRS was then performed using PRESS on the barrel cortex with the following parameters: TE/TR = 10/3000 ms; VOI size = 1.175 mm × 2.0 mm × 3.5 mm. To obtain sufficient signal-to-noise ratios (e.g., SNRs > 20) for further quantification, 292 averages were used for the acquisition. Experiments conducted under general anesthesia used 3% isoflurane for induction and 1.5% isoflurane for maintenance throughout the experiment. All other variables were identical between awake and general anesthesia mice experiments. Using water signal as a reference, absolute metabolite concentrations were calculated using LCModel.

## Results

Representative spectra with/without whisker stimulation under awake and general anesthesia are shown in the figure. C57BL/6J mice who underwent awake <sup>1</sup>H-MRS with whisker stimulation demonstrated increased Glu and Taur levels in the brain that were positively correlated ( $r = 0.85$ ), whereas GABA levels remained unaltered ( $r = -0.074$ ). No alterations in neurochemicals were observed with whisker stimulation under general anesthesia. TaurT KO mice had significantly lower Taur levels in the brain compared to C57BL/6J mice, which were not increased by whisker stimulation. This indicated that the whisker stimulation induced increase in Taur levels in C57BL/6J mice brains could be derived from the periphery *via* Taur transporters.



## Discussion

Given the positive correlation between Glu and Taur, whisker stimulation induced increase in Taur levels in C57BL/6J mice could be a mechanism for balancing the E/I ratio during neural activity, which is in accordance with the disinhibition of cell network activity in TaurT KO mice<sup>1</sup>.

## Conclusion

Our results demonstrated that Taur, which is derived from the periphery, participates in the E/I balance through its inhibitory role. We also demonstrated that <sup>1</sup>H-MRS under awake anesthesia was able to more evidently identify alterations in the amount of neurochemicals compared to that under general anesthesia in mice.

**References** 1) J Physiol 585.2 (2007) pp 539–548

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