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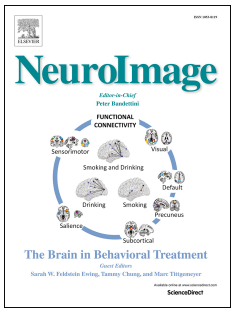

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Feasibility of imaging evoked activity throughout the rat brain using electrical impedance tomography

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Abstract

Electrical Impedance Tomography (EIT) is an emerging technique which has been used to image evoked activity during whisker displacement in the cortex of an anaesthetised rat with a spatiotemporal resolution of 200 μm and 2 ms. The aim of this work was to extend EIT to image not only from the cortex but also from deeper structures active in somatosensory processing, specifically the ventral posterolateral (VPL) nucleus of the thalamus. The direct response in the cortex and VPL following 2 Hz forepaw stimulation were quantified using a 57-channel epicortical electrode array and a 16-channel depth electrode. Impedance changes of -0.16 $\pm$ 0.08 % at 12.9 $\pm$ 1.4 ms and -0.41 $\pm$ 0.14 % at 8.8 $\pm$ 1.9 ms were recorded from the cortex and VPL respectively. For imaging purposes, two 57-channel epicortical electrode arrays were used with one placed on each hemisphere of the rat brain. Despite using parameters optimised toward measuring thalamic activity and undertaking extensive averaging, reconstructed activity was constrained to the cortical somatosensory forepaw region and no significant activity at a depth greater than 1.6 mm below the surface of the cortex could be reconstructed. An evaluation of the depth sensitivity of EIT was investigated in simulations using estimates of the conductivity change and noise levels derived from experiments. These indicate that EIT imaging with epicortical electrodes is limited to activity occurring 2.5 mm below the surface

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