

# Brain/core Discordance due to Neuronal Activity Identified by Noninvasive Brain Temperature Measurement via Brain-eyelid Thermal Tunnels

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## Abstract

We herein performed a series of brain/core temperature discordance studies in setting of brain excitation and depression to assess whether noninvasive temperature measurement at highly transmissive eyelid skin overlying newly discovered brain-eyelid thermal tunnel (BTT°) is specific for brain as opposed to core temperature (Core°). BTT°-Core° was determined during hypothermic cardiopulmonary bypass (CPB), seizures induced during electroconvulsive therapy (ECT), pharmacologic depression by sedation and anesthesia, sleep, stroke, brain trauma, and exercise in hot environmental chamber. During brain-core decoupling BTT° follows brain neuronal activity. BTT°-Core° varied dramatically due to extreme changes during CPB. During ECT, BTT° ipsilateral to induced seizure increased from  $36.38 \pm 0.4^\circ\text{C}$  pre-seizure to  $36.69 \pm 0.3^\circ\text{C}$  at two minute post-seizure ( $p < 0.001$  by paired t-test); Core° remained within  $0.01^\circ\text{C}$  of baseline ( $p = 0.2$ ). These changes were accompanied by BTT°-Core° discordance ranging from  $-0.1^\circ\text{C}$  pre-seizure to  $+0.31^\circ\text{C}$  post-seizure. Alternatively, during brain neuronal depression, BTT° ipsilateral to evolving ischemic stroke and Core° were  $35.37 \pm 0.2^\circ\text{C}$  and  $36.00 \pm 0.09^\circ\text{C}$ , respectively, with  $p < 0.0001$  for BTT°-Core° of  $0.63 \pm 0.13^\circ\text{C}$ . These findings document specificity of BTT transmission for brain thermal energy and illustrate potential BTT° usefulness in myriad clinical and investigative settings.

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