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# Defense-related inhibition of sympathetic nerve activity

## Insights from neuroimaging and monozygotic twins on related cortical processes and clinical potential

Akademisk avhandling

Som för avläggande av medicine doktorsexamen vid Sahlgrenska akademin, Göteborgs universitet kommer att offentligen försvaras i sal 2119, Hus 2, Hälsovetarbacken, Arvid Wallgrens Backe, fredagen den 18 juni 2021, klockan 13.00

av John Jonsson Eskelin

Fakultetsopponent:
Adj. Professor Vincenzo Donadio
University of Bologna, Italy

**Avhandlingen baseras på följande delarbeten**

I. Lundblad, L. C., Eskelin, J. J., Karlsson, T., Wallin, B. G., & Elam, M. Sympathetic Nerve Activity in Monozygotic Twins: Identical at Rest but Not During Arousal. *Hypertension* 2017; 69(5): 964-969.

II. Riaz, B., Eskelin, J. J., Lundblad, L. C., Wallin, B. G., Karlsson, T., Starck, G., Lundqvist, D., Ooostenveld, R., Schneiderman, J. F., & Elam, M. Brain structural and functional correlates to defense-related inhibition of muscle sympathetic nerve activity in man. *Manuscript*.

III. Eskelin, J. J., Lundblad, L. C., Wallin, B. G., Karlsson, T., Riaz B., Lundqvist, D., Schneiderman, J. F., & Elam, M. Simultaneous recordings of EEG and MSNA during somatosensory stimulation – prospects of a non-invasive biomarker for defense-related sympathetic inhibition. *Manuscript*.

**SAHLGRENSKA AKADEMIN**
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# Defense-related inhibition of sympathetic nerve activity

## Insights from neuroimaging and monozygotic twins on related cortical processes and clinical potential

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**Abstract**

This thesis investigates a physiological phenomenon observed in the peripheral sympathetic nervous system in response to various stressors and tries to bring it closer to clinical research. Sudden surprising stimulation can evoke a transient inhibition of sympathetic nerve activity to blood vessels in the human body which is also predictive of the blood pressure response. The underlying medical hypothesis is that this may be important for long term blood pressure. In Paper I we investigate the possible genetic contribution to this response pattern in a group of monozygotic twins. Results show that genes do not play a significant role in this response and so the clinical interest is strengthened. In Paper II, correlates to sympathetic inhibition are described in pre-defined areas of the cerebral cortex with magnetoencephalography (MEG) and magnetic resonance imaging. We find strong correlations related to stimulus processing and cortical thickness as an index of long-term plastic changes. The anterior cingulate, a region known to be involved in threat evaluation and autonomic control is implicated. In Paper III another of these correlates, namely beta oscillations in the sensorimotor cortex, is used to evaluate the feasibility of using a routine clinical electro-encephalogram (EEG) for non-invasive characterization of the peripheral nerve reaction. The prospect of using EEG as a simple mode of classification is not well supported but MEG remains a promising candidate for developing a non-invasive method of gauging individual defense-related responses. Given the role of hypertension as the leading risk factor for global disease burden, a continued evaluation of underlying mechanisms is essential.

**Keywords**: microneurography, MEG, EEG, MRI, blood pressure, defense reaction, cortical autonomic network

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