

Multi-transcriptional profiling of hypothalamic neurons: different functionalities in the control of energy homeostasis

*Harthoorn LF, Van Eden CG, Sañé A, Nethé M, Van Heerikhuizen JJ, Buijs RM*

Department of Hypothalamic Integration Mechanisms, Netherlands Institute for Brain Research, Amsterdam

Melanin-concentrating hormone (MCH) and orexin-containing neurons participate in hypothalamic circuits that control feeding. We examined intrinsic and functional properties of MCH and orexin neurons at single cell level in the rat lateral hypothalamus by a novel approach, combining immunocytochemical analysis of the peptide content with laser microdissection and pressure catapulting, followed by real-time qPCR. This technique provided a consistent representation of qualitative and quantitative transcriptional profiling of individually characterized neurons. Remarkable day-night differences and changes after fasting were found between MCH and orexin neurons at the level of functional output. MCH and cocaine-amphetamine regulated transcript (CART) are antagonistically regulated after fasting, while specific co-expression of glutamate- and GABA-markers uncovered a differentially regulated output between MCH and orexin neurons, especially during diurnal activity. Also expression of receptors reflecting their interaction with neuropeptide Y, melanocortins, leptin, and ghrelin showed crucial differences between these two peptidergic systems, emphasizing an obvious but specialized input of metabolic signals. This specific neuronal featuring demonstrates distinct ways of diurnal and metabolic integration, which is evidence for a functional differentiation between MCH- and orexin-containing neurons and their role in the regulation of feeding and energy homeostasis.

Lucien F. Harthoorn, Department of Hypothalamic Integration Mechanisms, Netherlands Institute for Brain Research (NIBR-KNAW), Meibergdreef 33, 1105 AZ Amsterdam, The Netherlands, e-mail [L.harthoorn@nih.knaw.nl](mailto:L.harthoorn@nih.knaw.nl)

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