Autonomic control of the skeletal muscle by the central clock

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Brain-body interactions through neural/endocrine pathways represents both efferent and afferent signalling between target and source. Innervation of the peripheral organs by different branches of the nervous sytem makes connection direct, faster and more specific than endocrine regulations. The Suprachiasmatic Nucleus (SCN), the biological clock, is located in the mammalian hypothalamus and controls our dialy physiology and metabolism by controlling the organ functions with a 24 hours rhythm by affecting sympathetic and parasympathetic branches of the autonomic nervous sytem as well as hormonal secretion. Uptill now, several multisynaptic pathways from autonomic clock to the to the peripheral organs were revealed by transneuronal virus tracing. Hence, the importance of these specific neural connections became available for functional experiments. For example, innervation of heart by both sympathetic and parasympathetic centers and connection of the SCN to these preautonomic structures, can explain shifting balances between sympathetic and parasympathic branches during the sleep-wake cycle and its effects on cardiovascular tone (e.g. while heart rate and arterial blood pressure increase by awakening, the rest state is characterized by decreased cardiovascular parameters). Locomotor activity and skeletal muscle tone is one of the other functional systems that acts in accordance to the cardiovascular system and works under the rhythmic control of biological clock. However, its connection to the autonomic nervous system in relation to the circadian function is not explored intensively. In the current study we explored possible conections of rat skeletal muscle to the autonomic centers and to the biological clock by using transneuronal virus tracing. Here, we revealed separate multisynaptic pathways from brain to the skeletal muscle including pre-autonomic sympathetic and parasympathetic centers and the SCN.

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