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Systems neuroscience

P5.08 The cellular and synaptic connectivity of the colliculo-thalamic network

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Associative learning is essential for adaptation in a constantly changing environment. When a neutral (conditioned) stimulus (e.g. sound; CS) appears along with an affective (unconditioned) stimulus (e.g. pain; US), a memory trace about the conditioned signal is formed. Then, at a later time-point, a fear response is elicited even if only the CS (the former neutral stimulus) is presented. This phenomenon is called associative fear learning. The anatomical background behind CS-US pairing contains a network, where these two pieces of information are able to converge on a single neuron. Our recent data suggests that this occurs before the conventionally accepted brain area, the lateral amygdala (LA), in the tecto-thalamic circuit, at the level of the LA-projecting calretinin-expressing lateral thalamic (CR+LT) cells. However, the exact anatomical evidences for this theory are missing. The tectal part consists of the midbrain's paired structures, the inferior (IC) and the superior colliculus (SC). They can transmit uni- and multimodal information (auditory, visual, somatosensory, etc.) to the thalamus. To investigate the organization principles of dual tecto-thalamic circuits, we used classical and viral tracing combined with immunohistochemical approaches in mice. We demonstrate that, although the colliculo-thalamic innervations have different topography, both are positioned to form synaptic contact on the same CR+LT cell. This convergence is likely to be present both between glutamatergic and the GABAergic collicular cell populations. Our findings show that multisensory information mediated by the SC and the IC can be converged on the same CR+LT cell. In summary, the presented tecto-thalamic pathways can jointly inhibit or excite the CR+LT cells and these complex synaptic transmissions can shape thalamic signal integration during the associative fear learning process.

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Registered participants

List of registered participants was prepared according to data available on 15 January, 2022.
Presenters' poster or lecture numbers are in bold.

A

Ábrahám, Hajnalka	P3.43, P3.44
Adalbert, Róbert	P3.29
Adlan, Leatitia Gabriella	P3.01 , P9.01
Adolf, András	P10.22
Adorján, István	S III.1 , P4.05, P4.10
Agócs-Laboda, Ágnes	P4.30, P4.31, P4.32, P4.33
Albert, Andrea	P5.03
Aldahabi, Mohammad	P4.03, P4.09
Al-omari, Ammar	P3.02
Alpár, Alán	P1.04, P3.26, P6.22
Ambrus, Géza Gergely	P6.02 , P6.21
Andreko, Alexandra	P7.16
Antal, Miklós	P4.01
Antal-Schnell, Ágnes	P5.05
Apáti, Ágota	P3.47, P4.40
Arrasz, Nikolett	P7.23
Arszovszki, Antónia	P4.06, P4.34
Asbóth, Barbara	P1.01

B

Babiczky, Ákos	P5.07
Bakacsi, Anna Virág	P5.08
Bakos, Emőke	P4.41
Balázs, Dávid Barnabás	P7.24
Bali, Zsolt Kristóf	P3.03 , P4.35, P6.20
Balind, Snezana Raus	
Balla, Gyula	P7.13
Barcsai, Livia	P3.21, P5.28 , P5.29
Barkóczi, Balázs	P10.01
Barsy, Boglárka	P5.10, P5.11