P28.15

Audio-motor and visual-motor synchronization in healthy children and children with cerebellum lesions

Anastasia Kovaleva[1,*], Victor Anisimov[2], Marina Shurupova[2]

[1] *Anokhin Research Institute of Normal Physiology, Moscow, Russia*
[2] *Lomonosov Moscow State University, Moscow, Russia*

The aim of the study was to reveal relations between cerebellum dysfunction and sensorimotor synchronization ability in children treated for posterior fossa tumor (PFT-group) and healthy children (control group).

Thirty-four children with a diagnosed medulloblastoma (mean age 12.44 ± 2.74) and 25 control children (mean age 12.32 ± 2.36) were given audio- and visual-motor synchronization tasks: tapping according to the metronome sounds or to the blinking square on the screen at 40 and 60 beats per minute for 30 s. Rhythm maintenance (inter-tap-intervals variance) was defined as the ability to produce regular inter-tap-intervals (ITI): the less ITI variance, the better rhythm maintenance. Rhythm accuracy (relative error) was defined as the difference between the child's tap and stimulus onset (the less this difference, the more accurate synchronization is). It could be either negative (a child taps before the metronome sound) or positive (a child taps after the metronome sound). The negative relative error means anticipation of the beat by a child (Repp & Su, 2013).

The results show that for all children it is easier to synchronize their hand movements with an auditory cue, then with visual. Synchronization with slow rhythm (40 bpm) is more difficult than with 60 bpm. There is a significant difference between two groups of children in ITI variance ($F = 8.88$, $p = 0.004$ for visual-motor test and $F = -4.04$, $p = 0.046$ for audio-motor test), but only for 60 bpm: patients with medulloblastoma demonstrated more variable rhythm maintenance. Rhythm accuracy is better in audio-motor tasks. There is no anticipation in visual-motor tasks in both groups. Healthy children are able to anticipate the sound, but patients are not. Correlation analysis between auditory and visual tasks performance showed that there are some significant correlations in PFT-group, but not in the control group.

The results suggest that cerebellum dysfunction associated with poorer sensorimotor synchronization ability, more notable for visual stimuli.

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P28.16

Prior expectation reduces the trial-by-trial variation of pursuit direction and interneuronal correlations in macaque area MT

Jeongjun Park, Seolmin Kim, Joonyeol Lee*

Sungkyunkwan University, Suwon-si, Republic of Korea

When we interact with the environment and make appropriate behavioral responses, our brain relies not only on the incoming sensory information but also on prior knowledge based on recent experience. The influence of prior knowledge becomes more prominent when the sensory evidence is weak or ambiguous. In this study, we investigated the competition between the sensory information and prior knowledge of incoming motion direction, using smooth pursuit eye movements in macaque monkeys. We controlled the monkey's prior expectation of motion direction and the strength of visual motion (100% vs 8% luminance contrast) independently. We found that the trial-by-trial variation of pursuit direction was significantly reduced when prior knowledge for motion direction was strong, especially if the sensory evidence for the motion was weak.

To understand the neural mechanisms of the effect of prior expectation on the sensory-motor behavior, we recorded responses of neurons in the middle temporal visual area (area MT), to the same visual stimulus in two different prior expectation conditions. We found that the firing rate, the direction tuning properties, and Fano factor of each neuron were not affected by prior expectation. However, the trial-by-trial correlation between activities of area MT neurons was significantly reduced by prior expectation in a 100% contrast condition. In agreement with the change in the inter-neuronal correlations, prior expectation also reduced the trial-by-trial correlation between single neural activity and pursuit direction variation in a 100% contrast condition. This result suggests that the reduction of behavioral variation by prior expectation can be partly explained by the reduction of correlated inter-neuronal variability in population activity of area MT neurons.

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P28.17

Effect of local hypothermia of the spinal cord on the motor evoked potentials of the hindlimb muscles after spinal cord injury in rat

Dinara Silantyeva*, Ekaterina Loban, Maria Raimova, Tatyana Baltina

Kazan Federal University, Kazan, Russia

The motor evoked potentials induced by the epidural stimulation of the spinal cord can be used for assessment of the sensory motor control of the hindlimb movement. In the present study we evaluated the functioning state of the spinal circuits of the hindlimb muscles in rats during 30 days after modeled spinal cord injury (SCI) and the treatment by local hypothermia of the spinal cord. The contusion SCI was modeled on the level of Th8–Th9 vertebrae, the local hypothermia was applied immediately after SCI at the site of injury for 20 min. The motor evoked potentials induced by epidural stimulation of L4 segment of the spinal cord were recorded from m. gastrocnemius, m. soleus, and m. tibialis anterior. The amplitude, latency and the threshold of generating of minimal response were analyzed. All procedures were made in accordance with bioethics norms.

It was found that on the 1st day after SCI the amplitude of the motor evoked potentials of the investigated muscles was decreased in a group of animals which received the treatment with hypothermia while the amplitude of the motor evoked potentials was increased in a group without treatment. The amplitude of evoked potentials remained decreased until 14th day after SCI in the group of animals with hypothermia. However the amplitude of potentials in the group without treatment restored to the values of intact animals on the 7th day after SCI in m. gastrocnemius and m. soleus.

The results allowed us to suggest that the treatment with local hypothermia can decrease the excessive excitability of spinal circuits observed in acute period of SCI, but it inhibited the further recovery of functions of the spinal circuits in chronic period of SCI in rat.

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