Influence of *Bacillus* sp. from permafrost on behavioral functions of the nervous system *Gallus gallus*

Sergei A. Petrov, RN PhD, Andrey M. Subbotin PhD, Alexandr A. Bazhin, Maksim V. Narushko and **Aleksandr A. Kastornov**
Tyumen Scientific Center, SB RAS, Tyumen, Russia

Global climate change leads to the degradation of polar ice and permafrost rocks of the Arctic zone. Permafrost rocks of the Arctic zone are original ecosystems and the sphere of activity of numerous types of microorganisms (MOs). Degradation of permafrost can contribute to the rapid spread of viable MOs from paleoecosystems into the environment. The article describes experimental studies of the influence of microorganisms isolated from permafrost on the psychophysiological parameters of birds. We found that genus *Bacillus* sp. from permafrost causes a changing pattern of the microbiota of the gastrointestinal tract. MOs have a significant impact on *Gallus gallus* in the early postnatal period. Consequently, changes in the behavioral reactions and psycho-emotional state occur of chickens (exploratory activity, cognitive psychological components, stress, and anxiety levels). Autonomic and higher nervous systems are involved in this regulatory process. They reflect an increase in the frequency of defecation and the appearance of interhemispheric asymmetry. The available information concerning the synthesis of neuropeptides by symbionts, primarily lactic acid bacteria, well illustrate these theses: they regulate the level of motor activity, emotional reactions, sociability, leadership, and other qualities of the host. MOs produce catecholamines. Catecholamines may help a person overcome depression, adynamia, and other consequences of stress. Hence, the desire to develop a new generation of probiotics with targeted neurochemical action and, in particular, the antidepressant effect becomes understandable.

Recent Publications

1. Oleskin AV, El-Registan GI, Shenderov BA (2016) Intermicrobial chemical interactions and the microbiota-host dialogue: the role of neurotransmitters. Microbiology. 85(1):3-25.
2. Smirnova TA, Zubasheva MV, Shevlyagina NV, Nikolaenko MA, Azizbekyan RR (2013) Electron microscopic study of the surface of bacilli spores. Microbiology. 82(6):698–706.
3. Malchevskiy VA, Subbotin AM, Nemkov AG, Petrov SA (2016) Effect of contamination with perennial permafrost microorganisms on the outcome of closed brain neurotrauma. Bulletin of experimental biology and medicine. 161 (3):388-390.
4. O'Mahony SM, Clarke G, Borre YE et al. (2015) Serotonin, tryptophan metabolism and the brain-gut-microbiome axis. Behavioural Brain Res. 277:32-34.
5. Verbrugge E, Boyen F, Gaastra W et al. (2012) He complex interplay between stress and bacterial indections in animals. Veter. Microbiol. 155:115-127.

Biography

Sergey Petrov has experience in assessing the biological potential of microorganisms in permafrost under modern climate change and technogenesis using various test objects. Developments in this area open up broad opportunities for microbial biotechnology for healthcare and agriculture. The research methodology is based on many years of experience in the leadership of the Cryosphere Bioresources Department of the Tyumen Scientific Center of the SB RAS. It allows value pluralism.