In memory of Lev Mukhametov (1938-2021)
Sleep in marine mammal species

A Russian biologist Lev Mukhametov (19.05.1938 – 18.06.2021) had worked most of his life at the Severtsov Institute of Ecology and Evolution of the Russian Academy of Sciences and had devoted a lot of his activities to investigating sleep in marine animals. In 1970s, L. Mukhametov leading a group of colleagues and collaborators discovered a phenomenon of unihemispheric slow wave sleep in dolphins. Unihemispheric slow-wave sleep appears alternatively in both hemispheres and is the dominant

to constant moving, behavioral observations alone cannot distinguish between sleep and wakefulness in dolphins (Zh Vyssh Nerv Deiat Im I P Pavlova, 1975; Physiol Behav, 2002, Neurosci Lett, 1987). Further studies suggested that sleep deprivation in one dolphin hemisphere led to an increase in sleep pressure and following rebound of delta sleep in the deprived hemisphere only; at the same time sleep in another, non-deprived hemisphere appeared normal and did not seem to compensate sleep loss in the deprived one (J Sleep Res, 1992).

In further studies, L. Mukhametov et al. confirmed unihemispheric sleep in some other cetacean species. In particular, beluga (white) whales also show predominantly unihemispheric sleep which correlated mostly with the closure of the contralateral eye and opened state of the ipsilateral eye. Episodes of bilateral eye closure were very short and seldom and comprise less than 2% recorded time. The authors concluded that unihemispheric sleep allows Cetaceans to monitor the environment and detect predators or danger (Behav Brain Res, 2002). So one of the biological functions of unihemispheric sleep is the animal protection. Other functions include the opportunity to surface regularly for breathing and thermoregulation (Zh Vyssh Nerv Deiat Im I P Pavlova, 2013).

Some other marine mammals (e.g. fur seals) show both bilateral and unihemispheric slow wave sleep dependently of the surrounding (Experientia, 1985). Fur seals and other eared seals in natural environment spent their feeding season in the open sea, and a breeding season on land. In the lab they demonstrated "dolphin-like" sleep while in water, that is, unihemispheric slow-wave sleep and almost complete absence of REM sleep. While on land, eared seals demonstrate typical terrestrian mammalian sleep: symmetrical slow wave sleep and a lot of REM sleep (J Sleep Res, 2008; J Sleep Res, 2012).

These and other findings by L. Mukhametov and his colleagues of sleep characteristics in marine species contributed a lot to the further understanding of local sleep and development of somnology.

Main papers by Lev Mukhametov et al.

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