

МАТЕРИАЛЫ КОНФЕРЕНЦИИ  
И ШКОЛЫ

EPENDYMINS: NEW DATA ON PARTICIPATION IN THE REGULATION  
OF PHYSIOLOGICAL AND BEHAVIORAL REACTIONS IN TELEOST FISH

© 2020 г. D. V. Garina<sup>1,\*</sup>, N. E. Lamash<sup>1,2</sup>, R. A. Fedorov<sup>1</sup>, I. P. Ryabtseva<sup>1</sup>,  
M. V. Serebryakova<sup>3</sup>, and A. M. Andreeva<sup>1</sup>

<sup>1</sup> Papanin Institute for Biology of Inland Waters, RAS, Borok, Russia

<sup>2</sup> Zhirmunsky Institute of Marine Biology, Far Eastern Branch, RAS, Vladivostok, Russia

<sup>3</sup> Lomonosov Moscow State University, Belozersky Institute of Physico-Chemical Biology, Moscow, Russia

\*e-mail: darina@ibiw.ru

DOI: 10.31857/S0044452920071778

Ependymins (Epd) are secretory glycoproteins that are the predominant protein component of cerebrospinal fluid in teleost fish (Hoffmann, 1992; Ganss & Hoffmann, 2009). Epd are synthesized in leptomeninx and are secreted into the extracellular fluid of the brain (ECF). Their discovery dates back to the mid 70's XX century (Shashoua, 1976). In addition to the long-known functions of these proteins (participation in the processes of learning, memory consolidation, and regeneration of nerve tissue new information has appeared about Epd functions in recent decades: participation in cold acclimation of fish, regulation of their aggressiveness and social status, regulation of seasonal reproductive cycles, and some others (Garina, in press).

We have analyzed seasonal changes of Epd concentration in the ECF of some freshwater (goldfish) and migratory (eastern redfins) cyprinids. The following methods were used: 1) SDS-electrophoresis (Laemmli, 1970), 2D-electrophoresis; 2) MALDI mass spectrometry; 3) determination of the concentration of total protein by microbiuret method (Itzhaki et al., 1964); 4) the determination of the relative protein content by electrophoregrams was performed using the ONE-Dscan soft-

ware package, Ver 1.31 (Scananalytic Inc.). By the example of goldfish, it was shown that the Epd concentration in ECF depends not only on the maturity stage of the gonads, but also on the sex of the fish: in summer, females and males of goldfish (maturity stage of the gonad 1–2) showed a value of  $0.80 \pm 0.07$  and  $0.38 \pm 0.16$  g% ( $p < 0.05$ ), respectively. In immature individuals, the concentration of Epd was  $0.73 \pm 0.16$  g% (Garina et al., 2017). At the same time, in redfins, the lowest value of Epd concentration in ECF was observed in immature individuals in spring:  $0.49 \pm 0.15$  g%. In sexually mature fish, the minimum value of the parameter was observed before spawning:  $0.74 \pm 0.17$  g%. It was established that the total protein content in the ECF of redfins, unlike other extracellular body fluids, is at a constant level throughout the year, and this constancy is ensured by seasonal variation in the Epd content (Andreeva et al., 2015). The results have been suggest the participation of Epd in the regulation of seasonal reproductive cycles, as well as maintaining brain homeostasis in teleost fish throughout the annual cycle.

Supported by state assignment (AAAA-A19-119102890013-3), RFBR 13-04-00427-a.