Short Paper

The Source Cell of the Pineal Mass Potential, Electropinealogram (EPG), of Rainbow Trout*¹

Pineal photosensory function in fish has been demonstrated by the electrophysiological studies of intra- and extracellular recordings from photoreceptor and ganglion cells.¹⁻⁶⁾ Mass responses, the EPG, to light stimulation has also been reported in several fishes.⁷⁻⁹⁾ Despite the fact that the origin of individual cell responses is known, the source of the EPG has not yet been clarified. There were suggestions in the lamprey⁸⁾ and the frog¹⁰⁾ that a structure other than the ganglion cells, i.e. photoreceptor cells, is responsible for the generation of a slow EPG wave. The present study demonstrates that the EPG of the isolated pineal organ of rainbow trout *Salmo irideus* originates from photoreceptor cells.

It is well known in the retina that the sodium aspartate affects postsynaptically the photoreceptors leaving electrical activities of photoreceptors intact, while other postsynaptic elements inactive.¹¹⁾ If sodium aspartate has the same effect on the pineal organ of fish it can reasonably be expected that only photoreceptor activities would be left normal, while ganglion cell activities would become inactive. Consequently, it is expected that the EPG wave form would be significantly altered by the application of the sodium aspartate in the case where ganglion cells participate in the EPG generation, while there would be no change when ganglion cells do not participate. The EPG was compared after treatment with the sodium aspartate and the Ringer's solutions. The sodium aspartate solution contained (in mM): Na Aspartate, 120; NaCl, 10; KCl, 3; CaCl₂, 2; NaHCO₃, 2; glucose, 50, while the Ringer's solution contained (in mM): NaCl, 130; KCl, 3; CaCl₂, 2; NaHCO₃, 2; glucose, 50. Concentration of sodium aspartate was high enough compared to that of the retina. Solutions used in the experiment were almost isosmotic (300 mOsm/Kg) to the blood of the rainbow trout. Recording and stimulating methods were the same described elsewhere.⁹⁾

The EPG was recorded from the dorsal pineal vesicle and was summated 10 times. After 10 minutes of dark adaptation, the isolated pineal organ was immersed into the sodium aspartate solution for 15 minutes in the dark. EPG was then recorded on the moist filter with the sodium aspartate solution. The result is shown in Fig. 1. The EPG wave is composed of diphasic, negative and positive, deflection which is the same wave form already reported elsewhere.⁹⁾

(Received July 13, 1981)

*¹ ニジマス松果体集合電位 (EPG) の発生細胞.

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Fig. 1. EPGs of the isolated pineal organ of rainbow trout after treated with sodium aspartate (Na-asp) and Ringer's solutions. Each response was summated for 10 times to each white light stimulation (10 lx, lower mark). Both records were obtained from the same preparation.

Following this experiment, the same pineal organ was immersed into normal Ringer's solution for 15 minutes in the dark. The EPG was then recorded on a moist filter with Ringer's solution at the same electrode location on the pineal vesicle as in the case of above experiment (Fig. 1, lower record).

However, the EPG did not show marked changes in the response amplitude and in the wave form. Accordingly, the results strongly suggests that the EPG of the isolated pineal organ of rainbow trout is the mass potential of photoreceptor cells rather than the ganglion cells.

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