

EVOLUTION OF PHYSIOLOGICAL FUNCTIONS OF MELATONIN IN INVERTEBRATES

Summary

Melatonin is one of most widespread biological particles. Till now its presence is confirmed in vast range of organisms belonging to bacteria, protozoa, plants, fungi and animals. Recent studies show a large number of roles played by this small molecule. They vary from protective role in intracellular metabolism to involvement in photoperiodism and circadian behaviour and all this only among vertebrates. Those facts rise question about processes which lead to such diversity. We looked into the model of evolution of melatonin functions proposed by HARDELAND and POEGGELER (2003). Authors suggest protective role in cell metabolism as free radical scavenger and antioxidant as the preliminary function of melatonin. Its relevance rose in cooperation with increasing concentration of oxygen both in cell and in environment (as a result of development of photosynthesis and mitochondria). As the photosynthesis is a circadian process concentration of oxygen in early atmosphere could also varied with circadian rhythm what could in turn cause rhythmic demand for antioxidant action. This process would later lead to endogenous circadian oscillation of melatonin

concentration triggered by light what resulted in involvement in photoperiodically regulated actions. We confronted the proposed model with results of melatonin-linked studies held on invertebrates – a polyphyletic taxon which presents many types of organisms physiology and morphology. In some cases research teams found multilevel involvement of melatonin in biology of investigated species. On the contrary to vertebrates, invertebrates show not only day-peak pattern of melatonin circadian concentration. Also night peaks and lack of rhythm were observed even in closely related species (e.g. Decapoda). Correlation between presence of exogenous melatonin and circadian behaviour modification was also shown in a few species. In spite of limited data and not large number of species investigated we can conclude that the model fits available data pretty well. Interesting conclusion of this review is that the new function of melatonin does not replace the older one, only develops in parallel. The natural selection process does not create a new attribute in response to environment challenge, it only adopts one of existing features of organisms.