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Role of estrogens in fish immunity with special emphasis on GPER1

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Abstract: It is well accepted that estrogens, the primary female sex hormones, play a key role in modulating different aspects of the immune response. Moreover, estrogens have been linked with the sexual dimorphism observed in some immune disorders, such as chronic inflammatory and autoimmune diseases. Nevertheless, their effects are often controversial and depend on several factors, such as the pool of estrogen receptors (ERs) involved in the response. Their classical mode of action is through nuclear ERs, which act as transcription factors, promoting the regulation of target genes. However, it has long been noted that some of the estrogen-mediated effects cannot be explained by these classical receptors, since they are rapid and mediated by non-genomic signaling pathways. Hence, the interest in membrane ERs, especially in G protein-coupled estrogen receptor 1 (GPER1), has grown in recent years. Although the presence of nuclear ERs, and ER signaling, in immune cells in mammals and fish has been well documented, information on membrane ERs is much scarcer. In this context, the present manuscript aims to review our knowledge concerning the effect of estrogens on fish immunity, with special emphasis on GPER1. For example, the numerous tools