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Zebrafish 20 β -hydroxysteroid dehydrogenase type 2 is important for glucocorticoid catabolism in stress response

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Stress as the physiological reaction to a stressor is initiated in teleost fish by hormone cascades along the hypothalamus-pituitary-interrenal (HPI) axis. Cortisol is the major stress hormone and contributes to the appropriate stress response by regulating gene expression after binding to the glucocorticoid receptor (GR). Cortisol is inactivated when 11 β -hydroxysteroid dehydrogenase (HSD) type 2 catalyzes its oxidation to cortisone. In zebrafish cortisone can be further reduced to 20 β -hydroxycortisone. This reaction is catalyzed by 20 β -HSD type 2, recently discovered by us. Here, we substantiate the hypothesis that 20 β -HSD type 2 is involved in cortisol catabolism and stress response. We found that *hsd11b2* and *hsd20b2* transcripts were up-regulated upon cortisol treatment. Moreover, a cortisol-independent, short-term physical stressor led to the up-regulation of *hsd11b2* and *hsd20b2* along with several HPI axis genes. The morpholino-induced knock down of *hsd20b2* in zebrafish embryos revealed no developmental phenotype under normal culture conditions, but prominent effects were observed after a cortisol challenge. Reporter gene experiments demonstrated that 20 β -hydroxycortisone was not a physiological ligand for the zebrafish GR or mineralocorticoid receptor but was excreted into the fish holding water. Our experiments show that 20 β -HSD type 2, together with 11 β -HSD type 2, represents a short pathway in zebrafish to rapidly inactivate and excrete cortisol. Therefore, 20 β -HSD type 2 is an important enzyme in stress response.

Biography

Jerzy Adamski is Head of Genome Analysis Center at Helmholtz Zentrum München (Germany), which integrates platforms of genomic, transcriptomic, proteomic and metabolomic research, promoting high throughput research in mechanisms of the development and progression of complex diseases. He has a large scientific record in steroid and lipid metabolism, molecular endocrinology and biomarkers of frequent human diseases. He published over 200 papers in peer-reviewed journals and acts as Editor-in-Chief for Journal of Steroid Biochemistry and Molecular Biology (Elsevier).

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