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Transgenerational developmental programming: Effects of pre-natal stress on the hypothalamo-pituitary-adrenal axis and behaviour in the Japanese quail

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Stress exposure during early-life is usually associated with detrimental effects on health and well-being. The hypothalamic-pituitary-adrenal (HPA) axis is one of the primary targets of this programming, which generally results in a hyperactive HPA axis and increased levels of anxious behaviours. Most research focused on these harmful effects. However, the environmental-matching hypothesis proposes that developmental stress programs physiology and behaviour in an adaptive way that can enhance fitness if early environments match those experienced later in life. We tested the potential beneficial effects that stress experienced during pre-natal development may have on adults at the neuroendocrine and behavioural level. We determined the effects of exposure to increased corticosterone during pre-natal development over two generations by quantifying: glucocorticoid (GR) and the mineralocorticoid (MR) receptor mRNA expression in the hippocampus, hypothalamus and pituitary gland; the acute CORT stress response and exploration in a stressful novel environment. We showed that pre-natal stress modified GR and MR expression in accordance with a more efficient negative-feedback within the HPA axis resulting in an attenuated stress response. In return these physiological responses mediated increased activity levels and exploration in a novel environment. This phenotype programmed by pre-natal stress was transmitted to offspring independently of their own developmental experience. Pre-natal stress could therefore program phenotypes in a way that may increase fitness when early and later environmental conditions match. This phenotype can also be transmitted to the next generation which may enhance offspring capacity to cope with stressful conditions.

Biography

Cedric Zimmer completed his PhD in 2010 at Strasbourg University in France. He is currently a Research Fellow at the School of Psychology and Neuroscience of the University of St. Andrews. He is mainly interested in the consequences of stress in animal models and particularly on the long-term effects of early life stress on brain, physiology and behaviour. He has published several papers in reputed journals.

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