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Age-associated changes in endocrine function and their implications for brain function and dysfunction

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Two of the most significant changes in hormones with increasing age are those in cortisol and dehydroepiandrosterone (DHEA). Cortisol levels tend to increase and the daily cortisol rhythm is altered. Both have potentially deleterious consequences for the brain. Unlike its peripheral action, cortisol is pro-inflammatory in the brain. Microglial activation, and the consequent release of cytokines, alters the permeability of the blood-brain barrier which removes some of its regulatory and protective actions on the brain, the constitution of the extracellular matrix, including perineural networks, that play essential roles in synaptic plasticity and memory, and in the formation of new cells in the hippocampus, also a major component of the mnemonic system. The actions of additional cortisol are amplified by the coincident decrease in DHEA, a prominent feature of ageing humans. DHEA moderates the action of cortisol, including those on immune function, inflammation and the rate of hippocampal neurogenesis, but also has cellular actions of its own. Astrocytes, because of their multiple influences on the blood-brain barrier, extracellular matrix and synaptic function, are major contributors to the process of ageing in the brain. These steroids act both directly on astrocytes, but also indirectly though their role on the low-grade inflammation that characterises old age. The combined change in these two hormones has profound consequences for cognitive and emotional function, including processing speed, executive function, semantic, episodic and working memory (so-called 'fluid' domains), but also emotional recognition and perception. Though age-related alterations in these steroids are a general phenomenon, there are marked individual differences in the rate at which they occur. This may explain some of the corresponding individual differences in brain function in older people.

Biography

Joseph Herbert is the Emeritus Professor of Neuroscience in the University of Cambridge. He was the former director of graduate training and previously, he was the coordinator at Marie Curie Initial Training Network. His research areas are: Neurochemical coding of behavioural and endocrine responses, with reference to the action of neuropeptides and steroids on adaptive responses. The cellular and molecular action of neuropeptides. The neuro recording regulation of hippocampal neurogenesis. The role of genes, stress, steroids, amines and peptides in affective disorders. Neural and genetic factors in the control of financial decision-making.

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