

## FROM MOLECULES TO MIND: STRESS, ALLOSTASIS AND INTEGRATION OF BRAIN AND BODY

**B. McEwen**

**Laboratory Of Neuroendocrinology, The Rockefeller University, New York, USA**

The mind involves the whole body and two-way communication between the brain and the cardiovascular, immune and other systems via neural and endocrine mechanisms. Stress is a condition of the mind and a factor in the expression of disease that differs among individuals. A broader view is that it is not just the dramatic stressful events that exact their toll but rather the many events of daily life that elevates activities of physiological systems so as to cause some measure of wear and tear. We call this wear and tear 'allostatic load', and it reflects not only the impact of life experiences but also genetic load; individual life-style habits reflecting items such as diet, exercise and substance abuse; and developmental experiences that set life-long patterns of behavior and physiological reactivity (1).

Hormones associated with stress and allostatic load protect the body in the short-run and promote adaptation, but the long run allostatic load causes changes in the body that lead to disease. This will be illustrated for the immune system and brain regions involved in stress, fear and cognition (e.g. hippocampus, amygdala and prefrontal cortex). Besides developmental influences associated with mother–infant interactions, the most potent of stressors in adult life are those arising from competitive interactions between animals of the same species, leading to the formation of dominance hierarchies. Psychosocial stress of this type not only impairs cognitive function of lower ranking animals, but it can also promote disease (e.g. atherosclerosis) among those vying for the dominant position, as well as depressive illness. Social ordering in human society is also associated with gradients of disease, with an increasing frequency or mortality and morbidity as one descends the scale of socioeconomic status (SES) that reflects both income and education. Although the causes of these gradients of health are very complex, they are likely to reflect, with increasing frequency at the lower end of the scale, the cumulative burden of coping with limited resources and negative life events as well as differences in life style, and the allostatic load that this burden places on the physiological systems involved in adaptation and coping.

(1) McEwen, B.S. (1998) Protective and damaging effects of stress mediators. *New England J. Med.* **238**, 171–179.