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Author: Yves Tillet

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Editorial

Brain plasticity from fundamental research to clinic

Yves Tillet[1] and Sylvie Chalon[2]

1- Physiologie de la Reproduction et des Comportements, UMR 0085 INRA, 7247 CNRS, Université de Tours, IFCE, SFR FED4226 Neuroimagerie Fonctionnelle. 37 380 Nouzilly. France
2- UMR 1253, iBrain, Université de Tours, Inserm, Tours, France, SFR FED4226 Neuroimagerie Fonctionnelle, 10 Bd Tonnellé, 37032 Tours Cedex 01, France

The existence of neuronal plasticity was first proposed by Hebb (1949) almost 70 years ago, with the observation that patterns of coincident neuronal firing lead to structural changes that strengthen a synapse. Later on, in the eighties, pioneer works were performed in the field of neuroendocrinology, by Theodosis and Poulain (1984) concerning the neuronal reorganization in the supraoptic nucleus of the hypothalamus during lactation in the female rat and by Goldman and Nottebohm (1983) who described the production of new neurons in the vocal control nucleus of the adult female canary brain. Since these periods numerous research in laboratory animals has led to increase our understanding of brain plasticity at cellular and system levels.

This intrinsic properties of the brain make possible the physiological and behavioural adaptations of the organism to the environment through synapse remodelling and neurogenesis. These modifications were described in various situations including in human using MRI studies, as shown in London taxi drivers (Maguire et al., 2000).

In this review we wanted to point out the most recent developments concerning brain plasticity, from fundamental aspects to its involvement in therapy.

In the wide field of neuroendocrinology, a large number of hormones has strong effects on brain plasticity. Among them estradiol is not only involved in the central control of reproduction but has generalized actions on the brain. Indeed, it is well-known that neurons, glial cells as well as cerebrovascular vessels are targeted by estradiol. This hormone is synthesized not only in the ovary but also locally in the brain through testosterone aromatization by the enzyme aromatase. This enzyme is found in various brain cells such as neurons and glia, both in physiological and pathological conditions. In his review Azcoitia et al. discussed the role of aromatase in estradiol synthesis and various aspect of synaptic and neuroplasticity events involved in the control of cognitive function and behaviour, under the light of their last findings.

Synaptic organization and neurogenesis are involved in neuronal networks activity, and this second paper focus on the plasticity of these networks. Plasticity induced by intensive learning has been previously demonstrated in Londoner taxi drivers, showing an increase of grey matter volume in the posterior hippocampus of expert drivers (Maguire et al., 2000). It is admitted now that motor and cognitive stimuli induced brain plasticity, and since about fifteen years, the influence of music which includes both motor and cognitive aspect becomes a model of choice for such studies. P. Cantou and collaborators analyse the effect of expertise on whole brain plasticity without any task, using MRI and EEG for evaluation of resting state functional connectivity. Their review indicates that brain plasticity is induced by all domains of expertise regardless of the activity type, and they hypothesize that the