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An Updated Role for Nerve Growth Factor in Neurobehavioural Regulation of Adult Vertebrates

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SUMMARY

Increasing attention has been focused on the role(s) of nerve growth factor (NGF) in neurobehavioural regulations of adult vertebrates. This interest springs from the emerging evidence that NGF is a "regulator" of physiological processes belonging to the three main homeostatic systems: the nervous, immune and endocrine systems. In fact, the spectrum of action of the NGF molecule is not restricted to neuronal cell types (central basal forebrain; peripheral sensory and sympathetic neurons) but extends also to non-neuronal cells. In mice intermale aggressive behaviour enhances serum NGF levels and promotes its synthesis in some hypothalamic areas. Other types of social events are able to cause NGF release, particularly under stress conditions. The achievement of a social role (dominant vs subordinate) is due to a functional loop involving salivary NGF release → enhanced production of adrenal hormones → submissive behaviour → NGF release. In humans, plasma platelet-derived growth factor (PDGF) increases following mental stress. The aim of this review is to give an updated survey on NGF roles in neurobehavioural regulations of adult animals.

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AN UPDATED ROLE FOR THE OLD NGF MOLECULE

Nerve growth factor (NGF) has been considered for almost 35 years as a potent and rather selective growth stimulator of peripheral, sympathetic and sensory neurons and other neural crest-derived cells. It has most effect on developing and growing neurons, and on certain non-neuronal cells, but causes hypertrophic growth of neurites in adult neural tissue as well (for review, see /76, 114, 117, 119, 172/).

More recent work has shown that NGF is produced in the central nervous system (CNS), that central neurons bear NGF receptors, and that NGF exerts trophic actions on the cholinergic neurons of the basal forebrain /67, 102, 159, 183/. A role for NGF in developing rat cholinergic /129, 130/ and *Xenopus* peptidergic /115/ neurons has also been found. However, the dogmatic view of a strict specificity of NGF at the CNS level for cholinergic neurons has been challenged, e.g. /34/.

Although the trophic and differentiative effects of NGF on developing peripheral and central neurons have been extensively studied in the past /76, 114, 172/, only recently has the possible role of NGF in adult physiological regulations been thoroughly investigated /4, 10, 105, 106, 165/. Mobley *et al.* /168/ characterized the NGF octapeptide acting as a hyperalgesic agent capable of altering the pain threshold in injured target regions of NGF-responsive neurons. Epidermal growth factor (EGF), which was considered almost exclusively a growth factor (GF) specific for