ROLE OF FEED-BACK MECHANISM IN THE REGULATORY FUNCTIONS OF THE BRAIN

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The central nervous regulation of various somatic activities, which adjust the res of the body in relation to external environment, and regulation of various viscera l and en nal activities which achieve maintenance of the constancy of the *milieu interieur* (home conditions), are similar to each other. Only the circuits involved and the central ne regions through which integration takes place are different.

The nervous centres which regulate and integrate these various activities have to b plied with the information which forms the basis for such regulation. The information plied to the somatic regulatory nervous centres comes mainly through the afferent sensory from somasthetic, proprioceptive and other special distant sensory end organs. Ho the nervous centres which regulate and integrate the internal (visceral) activities are su by information about changes in the homeostatic conditions in two ways The. afferent coming from the internal organs involved in any activity transmit rapidly acting messa the nervous centres which give it information about the activities of these organs. As centres have to regulate the homeostasis in a very efficient manner, the change or change duced in the internal environment, as a result of any activity, also affect the nervous regu mechanisms specific for this. This is provided through feed-back of this information via cal or physical means. This second feed-back, as against the nervous feed-back, is a ve portant mechanism for influencing the regulatory functions of the brain.

The arrangements on the two sides may be summarised as follows. On the s side, the sensory inputs come mostly from peripheral structures of the body. They dete many of the activities which depend upon reflex actions concluded through the spinal or stem levels. The afferents also ascend and send first relays into the brain stem regio reticular formation, which regulates postural and other allied activities, again reflexly. sensory impulses are finally relayed to the sensory areas of the brain. The execution of ments is initiated from the motor areas, by their either facilitating or inhibiting the lower outflows. Between the sensory and motor regions are large neocortical association are integrating and modulating various somatic activieties.

There is enough suggestive evidence that the regulation of visceral activities is sim patterned. The sensory inputs, coming from various internal organs, form the basis of re

which are completed through spinal and brain stem levels. The afferents ascend and they have relay centres in the brain stem for special reflex activities, such as cardiac, vaso-motor, respiratory centres etc. Finally, most of these afferents project to the hypothalamus, and possibly some into limbic regions. The hypothalamus, is like the motor area, in as much as it executes the different activities which ultimately regulate the *milieu interieur*. This it does by providing facilitatory and inhibitory controls over autonomic outflows, thus modifying reflex activities mediated from brain stem and spinal levels. The secretion of hormones through the pituitary gland is also regulated. The hypothalamus is extensively inter-connected with the various limbic structures and these regions, therefore, possibly subserve functions of integration and modulation similar to those of neocortical association areas.

In addition to the afferents coming from the visceral structures, changes produced in the internal environment also feed-back into these nervous regulating mechanisms. Although the feed-back information through nervous sensory afferents has been investigated and accepted for a long time, the concept of feed-back of information through changes introduced in the *milieu interieur* itself is a new one. One can theoretically consider that the higher nervous - integrating and regulating mechanisms in the hypothalamus and limbic system could possibly manage to keep the constancy of the *milieu interieur*, if there is a feed-back of information to these in terms of all possible changes affecting the internal environment. This means that there must be specific neurones which are senstitive to the various kinds of changes in the internal environment. Previous experimental observations have demonstrated thermo-sensitive and osmo-senstitive neurones in the hypothalamus. We have recently put forward direct experimental evidence demonstrating the presence of gluco-sensitive neurones in the hypothalamus. Experimental information has also been provided that some hypothalamic cells, which bring about drinking, are sensitive to injections of hypertonic saline. Feed-back of endocrine hormones into the higher central nervous system is already an accepted fact. I hope that the day is not far distant when neurones sensitive to other components of the internal environment will be demonstrated. Otherwise, how can one explain such experimental observations as the preferential selection by animals, with sodium or calcium deficiency, for diets containing these elements?

I am not suggesting that such receptors to the components of the *milieu interieur* are present only in the central nervous system. They could well be found even at the periphery, and experimental evidence is gradually accumulating in favour of this also.