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horseradish peroxidase

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nervous system, human

Functions of the human nervous system

The human nervous system differs from that of other mammals chiefly in the great enlargement and elaboration of the cerebral hemispheres. Much of what is known of the function of the brain is derived from observations of the effects of disease or by analogy with the results of experimentation on animals, particularly the monkey. Such sources of information are clearly inadequate for the elucidation of the nervous activity underlying many properties of the human brain--particularly speech and mental processes. It is not surprising, therefore, that knowledge of the functions of this uniquely complex system, although rapidly expanding, is far from complete.

In the following account of the functions of the human nervous system, there are numerous references to tracts and to less well-defined connections between different regions of the brain and spinal cord. The identification of these pathways is not always a simple matter; indeed, in humans, many are incompletely known or are simply conjectural.

A great deal of information has been obtained by observing the spreading effects of axonal destruction. If a nerve fibre is severed, the length of axon farthest from the cell body, or soma, will be deprived of the axonal flow of metabolites and will begin to break up. The myelin sheath will also degenerate, so that, for some months after the injury, breakdown products of myelin will be seen under the microscope with special stains. This method is obviously of limited application in humans, as it requires precise lesions and subsequent examination before the myelin has been completely removed. The staining of degenerated axons and of the terminals that form synapses with

[redacted]

more general

- nerve ending
- sensory neuron

more specific

types

- enteroceptor
- exteroceptor
- subcutaneous receptor

by stimulus

- chemoreceptor
- mechanoreceptor
- nociceptor
- photoreceptor
- pressure receptor
- proprioceptor
- tangoreceptor
- thermoreceptor

properties

- receptor potential
- surround inhibition

other

- acoustic sensillum receptor

other neurons is also possible using silver impregnation, but the techniques are laborious and results sometimes difficult to interpret.

That a damaged neuron should show degenerative changes, however difficult to detect, is not unexpected, but the interdependence of neurons is sometimes shown by transneuronal degeneration. Neurons deprived of major input from axons that have been destroyed may themselves atrophy. This phenomenon is called anterograde degeneration. In retrograde degeneration, similar changes may occur in neurons that have lost the main recipient of their outflow.

These anatomical methods are occasionally applicable to human disease. They can also be used postmortem when lesions in the central nervous system have been deliberately made--for example, in the surgical treatment of intractable pain. Some more recently developed techniques can be used only in experiments on animals, but these are not always relevant to humans. For example, normal biochemical constituents labeled with a radioactive isotope can be injected into neurons and then transported the length of the axon, where they can be detected by picking up the radioactivity on an X-ray plate.

An observation technique dependent on retrograde axonal flow has been used extensively to demonstrate the origin of fibre tracts. In this technique, the enzyme **peroxidase** is taken up by axon terminals and is transported up the axon to the soma, where it can be shown by appropriate staining.

The staining of neurotransmitter substances is possible in postmortem human material as well as in animals and is an important method. Success, however, is dependent on examining relatively fresh or frozen material, and results may be greatly affected by previous treatment with neurologically active drugs.

Electrical stimulation of a region of the nervous system gives rise to the generation of nerve impulses in centres receiving input from the site of stimulation. This method, using microelectrodes, has been widely used in animal studies. The precise path followed by the artificially generated impulse may be difficult to establish.

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