

# Functional Organization Of The Nervous System

## Anatomical Principles

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Initially it was thought that the nervous system, and specifically the brain, operated holistically in a global fashion, i.e., as an undifferentiated whole to carry out all of its functions. This was referred to as globalization, in distinction from localization that held that different functions were carried out in different areas of the brain.

The localization position later became the dominant one, and led to the concept of centers in the brain, each devoted to a different function. For example, there was said to be an excitatory center for hunger and eating behavior, as well as an inhibitory center for satiation. Similarly, it was claimed that there were centers for the other motivated and emotional behaviors, as well as for the various cognitive activities such as perception, learning, memory, and language.

It is now recognized that the truth lies somewhere in the middle, i.e., that most behavioral and cognitive functions of the nervous system are handled by:

1. *Diffusely distributed systems, or networks* (but not the whole brain);
2. Incorporating a number of *interconnected localized structures/modules*;
3. Organized in a *hierarchical* fashion (as in a business or military organization);
4. But with *parallel, concurrent processing pathways and centers/modules* for various specific subfunctions, or submodalities;
5. Employing *feedback*, as well as *feedforward*, for effective regulation and coordination among the network of structures that make up the systems.

Examples of these, distributed, hierarchical, parallel networks are: the numerous visual system pathways specialized for processing form, color, shape, location, movement, etc.; and the pyramidal and extrapyramidal pathways of the motor system.

Division of labor: The more *recently evolved, higher structures* (e.g., secondary and tertiary neocortical areas) deal with the more *abstract levels* of information processing and decision making, such as *perceptual* recognition of whole objects and their significance/meaning, and *behavioral/motor* planning. The *older, lower structures* (e.g., brainstem and spinal areas) deal with the more *concrete* perception of stimulus components and the contraction of specific muscles. Moreover, higher structures exert influences largely by *regulating* the activity of lower structures through disinhibition.