Concerning three rhinencephalic systems, Karl H. Pribram, Department of Neurophysiology of the Institute of Living, Hartford, Conn., and Department of Physiology, Yale University, New Haven, Conn.

Because of the recent interest in the possible role in emotional behavior of parts of the forebrain which previously had been thought to serve olfaction, the author has reviewed and made an attempt to systematize observations and experiments concerning the anatomy and functions of those neural systems which might usefully be classified as "rhinencephalic".

A classical distinction between neocortical and older formations is abandoned in favor of the distinction between isocortex on the one hand and allo-juxtallocortex on the other.

Three allo-juxtallocortical systems have been distinguished. The first (made up of olfactory tubercle, area of the diagonal band, prepyriform cortex, and the corticomedial nuclei of the amygdala) is considered a "primary" olfactory system on the basis of its direct connections with the olfactory bulb. A second system (made up of subellar and frontotemporal juxtallocortex, the septal nuclei and basolateral amygdaloid nuclei) is connected with the primary system but not with the olfactory bulb and contains subcortical as well as cortical components. The lack of differentiation between cortex and subcortical (cortical and subcortical) formations in this system is found whether phylogenetic, histogenetic, axonographic, physiological, or behavioral data are considered. This system has been implicated in diverse functions: metabolic and endocrinological, and emotional. Future investigation must determine whether some unitary function underlies the others.

![Diagram of formations discussed in this review](image-url)
whether the multiplicity of functions reflects a multiplicity of subdivisions within the second system, or whether this system is, under different conditions, part of one or another larger system. Finally, a third system connected with the second, but not the first (made up of the remaining olfactory-cortical structures: Ammon's formation, entorhinal, retrosplenial and cingulate cortex) can be distinguished from the others on a histogenetic, axonographic, and electrographic basis. The hypothesis that this in interpreting the results was urged, however, pending the accumulation of a wider range of data.

We must end with the thought that the "olfactory brain", as defined, is not primarily olfactory though parts of it serve olfactory functions. Nor is the current conception of a "visceral brain" more tenable though visculo-autonomic functions are also served. It is clear that the formations in this portion of the brain, though they share several characteristics, are not, at this time, usefully thought of as a brain

system is the neural base of emotion has so far failed to receive conclusive experimental confirmation. This may be due in part to the lack of quantitative behavioral studies of the effects of stimulation or ablation of portions of this system and to their surgical inaccessibility. These shortcomings are being overcome and relevant data should be forthcoming.

One example of the type of study needed was shown. This experiment demonstrated the selective effects of around and thalamic system resections on the extinction of a postoperatively acquired conditioned avoidance (possibly a response based on "fear"). Caution serving any one function. Since at least three distinct systems can be delineated, each might profitably be investigated separately before an attempt is made to define what functions they have in common.

REFERENCES

This report is abstracted from "Functions of the Olfactory Brain" by Pribram and Krujeg, Annals of the New York Academy of Sciences, 62: 199-208, March 24, 1958. A detailed bibliography can be found with the original article.