Kuhlenbeck: The Central Nervous System of Vertebrates

Hartwig Kuhlenbeck

The Central Nervous System of Vertebrates

A General Survey of its Comparative Anatomy with an Introduction to the Pertinent Fundamental Biologic and Logical Concepts

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Derivatives of the Prosencephalon: Diencephalon and Telencephalon

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«Die vergleichende Anatomie, Histologie, Architektonik und Embryologie des Zentralnervensystems bildet ferner einen umfangreichen Zweig und zugleich eine unentbehrliche Methode der neurobiologischen Forschung. Sie verrät die zahlreichen Wege, durch welche die Evolution der Nervensysteme der verschiedenen Tiersorten im phylogenetischen Zusammenhang ihre heutige Verschiedenartigkeit zustande gebracht hat. Vertieft man sich dabei genügend in den Zusammenhang von Form und Funktion, so gelangt man in eine wunderbare Welt der Harmonie zwischen Geist und lebendem Nervensystem...

Wer vergleichende Anatomie des Nervensystems sagt, sagt also auch vergleichende Physiologie - Psychologie und - Biologie, und das ist ein Gebiet, aus welchem die künftige Forschung mit vollen Zügen schöpfen kann...

Dass der Mensch für den Menschen sich Zunächst interessiert, ist verzeihlich und naheliegend. Hat er aber einmal erkannt, dass er nur ein Glied in der Tierreihe bildet und dass sein Hirn, das Organ seiner Seele, aus dem Tiergehirn und somit aus der Tierseele stammt, so muss er doch zur Erkenntnis gelangen, dass das Studium der Neurobiologie dieser seiner Verwandten das grösste Licht auf sein eigenes Nerven- und Seelenleben werfen muss.»

August Forel

(«Die Aufgaben der Neurobiologie»)

Preface

The lectures on the central nervous system of vertebrates, given by the author during his first sojourn in Japan, 1924-1927 (Taishō 13 to Shōwa 2), intended to foster the interest in comparative neurologic studies based upon the morphologic principles established by the Gegenbaur or Jena-Heidelberg School of Comparative Anatomy. Notwithstanding their introductory and elementary nature, these lectures,
published by Gustav Fischer, Jena, in 1927, included a number of advanced as well as independent concepts, and represented, as it were, the outline of a further program. Despite various vicissitudes, and although I found the prevailing intellectual climate in the realm of biologic sciences rather unfavorable to the pursuit of investigations related to the domain of classical morphology, I have, tant bien que mal, carried on with my studies as originally planned, and propose to summarize my viewpoints in the present series, designed to represent a general survey, and projected to comprise five separate volumes, of which the first two are now completed. It can easily be seen that the present series follows closely the outline of my old 'Vorlesungen', meant to stress 'die grossen Hauptlinien der Hirnarchitektur und die allgemeinen Gesetzmässigkeiten, welche in Bau und Funktion des Nervensystems erkannt werden können'.

Comparative anatomy of the vertebrate central nervous system requires a very broad and comprehensive background of biological data, evaluated by means of a rational, consistent, and appropriate logical procedure. Without the relevant unifying concepts, comparative neurology becomes no more than a trivial description of apparently unrelated miscellaneous and bewildering configurational varieties, loosely held together by a string of hazy 'functional' notions. A perusal of the multitudinous literature dealing with matters involving the morphologic aspects of neurobiology reveals, to the critical observer, considerable confusion as regards many fundamental questions. For this reason, the present attempt at an integrated overall presentation includes a somewhat detailed scrutiny of problems concerning the significance of configuration and configurational variety with respect to evolution and to correlated reasonably 'natural' taxonomic classifications. Because comparative anatomy of the central nervous system embodies the morphological clues required to infer the presumable phylogenetic evolution of the brain, a number of general questions referring to ontogenetic evolution are critically considered: it is evident that both the inferred phylogenetic sequences and the observable ontogenetic sequences represent evolutionary processes suitable for a comparison outlining the obtaining invariants. Moreover, the comparison of organic forms involves procedures closely related to analysis situs. Thus, a simplified and elementary
discussion of the here relevant principles of topology was deemed necessary. Finally, since vertebrate comparative anatomy and vertebrate evolution, including the origin of vertebrates, cannot be properly assessed in default of an at least moderately adequate familiarity with the vast array of invertebrate organic forms, a general and elementary survey of invertebrate comparative neurology from the vertebrate neurobiologist's viewpoint, that is as seen by an 'outsider' with a modicum of first-hand acquaintance, has been included as volume two of this series. The approximately 20 pages and 12 figures dealing with this matter in my 1927 'Vorlesungen' have thus, of necessity, become rather expanded.

US N.I.H. Grant NB 4999, which is acknowledged with due appreciation, made possible the completion of Volumes 1 and 2 of this series, and, for the time being, the continuation of these studies, by supporting a 'Research Professorship' established to that effect, following my superannuation, at the Woman's Medical College of Pennsylvania.

Concluding this preamble to the present series, I may state with Cicero (De oratore, III, 61, 228): 'Edidi quae potui, non ut volui sed ut me temporis angustiae coegerunt; scitum est enim causam conferre in tempus, cum afferre plura si cupias non queas.'

H.K.

Foreword to Volume 5, Part I

The large amount of material to be dealt with in volume 5 of this series made it necessary, as in the case of volume 3, to publish the present volume in two separate parts. Accordingly, the first part of volume 5, containing chapters XII and XIII, deals with the Vertebrate Diencephalon and Telencephalon. In chapter XIII, of which section 10 concerns the basic morphologic and functional aspects of the endbrain in Mammals, only the overall features of the diversified Mammalian telencephalic surface configuration and of the Mammalian cerebral cortex are here considered.

With regard to receptor structures, and supplementing chapter VII of volume 3/II as well as section 1, chapter IX of volume 4 (otic apparatus), the optic and the olfactory organs are passed under review in appropriate sections of chapters XII and XIII.

The second part of volume 5, containing chapters XIV, XV, and XVI, deals with details of Mammalian telencephalic surface morphology and of cerebral cortex, including thereto related relevant 'interdisciplinary' topics, and, in a similar manner, with the Vertebrate neuraxis as a whole.
It should again be stated that the bibliographies appended to the chapters of this series are meant to be selective, but should easily enable those interested in further particulars to find the required additional references.

As in the preceding volumes, numerous duly credited illustrations were taken from the public domain of published scientific literature also including contributions by my collaborators and myself. Illustrations without credit reference are previously unpublished originals from my own studies.

As before, I am obliged to the Medical College of Pennsylvania for the facilities of my 'Laboratory of Morphologic Brain Research', and particularly grateful to the Alumnae Association of the whilom Woman's Medical College of Pennsylvania, which includes my many former students, for the continued generous contributions to the funds necessary for my work.

H.K.

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