

BIOCHEMISTRY OF THE DEVELOPING NERVOUS SYSTEM

Proceedings of the First International
Neurochemical Symposium, Held at
Magdalen College, Oxford, July 13-17, 1954

Edited by
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PREFACE

The problem (. . . the relation between brain and mind . . .) has one virtue at least, it will long offer to those who pursue it the comfort that to journey is better than to arrive; but that comfort assumes arrival.

Sir Charles Sherrington (1933).

The First International Neurochemical Symposium, the Proceedings of which are recorded in this volume, was held at Magdalen College, Oxford, during the week of the 12th to the 19th July, 1954, under the title of "Chemistry in Relation to the Development of the Nervous System." The idea of the symposium arose in the course of conversations between us several years ago, and was later expanded with our colleagues who, with us, have since constituted the Organizing Committee. The Symposium is envisaged as the first of a series, the aim of which, over the years, will be to define and summarize the state of neurochemistry in its varying aspects and implications. It is also hoped that these meetings will stimulate research in the neurochemical field, particularly in the countries where intensive work in this field is presumably not underway.

The program of this First Neurochemical Symposium may perhaps come as a surprise to some. Nevertheless, it accurately reflects the joint opinion of the Organizing Committee as to the goal and purpose of modern neurochemistry. We agreed readily that we wanted to define our ignorances, as well as to discuss our knowledge, and that we wished to express our ideas and our hopes concerning the future of the chemical physiology and pathology of the nervous system in broadest terms. We agreed also that from the start it would be well to consider the brain as a biological entity in all its complexity of morphology and function, rather than as a homogenate, or an engineering problem. For that reason, we felt that the most useful contribution of a Symposium of this kind would be an attempt to re-integrate biochemical process with structure and function, particularly with respect to the chemical topography of the brain, which, to us, seemed of greatest moment in an understanding of function. The program thus not only represents the framework of a conference, but also expresses an attitude; and of necessity includes discussion of structural, genetic, and pathological aspects, as well as subject matter which, in the more limited sense, may be termed "neurochemical." We feel that this approach may be helpful in slowly building the foundations for a rational therapy of disorders of the nervous system.

The logical subject for the first of a series of Neurochemical Symposia

seemed to be a discussion on chemistry in relation to the development of the nervous system. The Committee felt somewhat anxious at first that this topic might prove too slender to form the subject of a five-day conference. This fear, however, was unjustified. Not only were evening sessions needed to supplement day sessions, but Chairmen had to cut short discussion after every paper for lack of time. It will be apparent from the content of this volume that some discussions centered on subjects documented by meager facts. This was intentional, and only stresses areas where intensive work is urgently needed.

The Symposium was divided into reviews and short summaries of original work. Authors were encouraged to extend in print the discussion of subjects which could not be adequately covered in the course of their verbal presentation. Informal discussions were recorded, and the transcripts edited by the authors. One evening session was devoted to the showing of films by Drs. H. Bickel, D. Bovet, W. Feldberg, and A. F. W. Hughes.

A list of participants is included, and it will be noted that they came from many countries. Delegates were sponsored by private or governmental agencies of their own countries.* The Mental Health Research Fund of Great Britain acted as hosts of the conference. It is to them that the thanks of all participants are due for providing the perfect setting of Magdalen College, and for the hospitality which undoubtedly contributed greatly to the success of the Symposium. Miss Y. Lines and Mrs. L. Richardson undertook the strenuous task of transcribing the informal discussions immediately, so as to have them available to individual members within 24 hours. Drs. P. B. Bradley and J. T. Eayrs, and Messrs. A. Todrick and L. F. Williams were most helpful with the administrative details of the conference, and members are greatly indebted to them for making their stay so pleasant, and so comfortable. The book could not have been published without the diversified efforts of Dr. Dorothea Rudnick; in addition to her active participation in the conference, she also acted as Editor of the discussion and constantly kept the attention of participants on the record of the Proceedings.

Finally, the Committee were greatly concerned during the organization

*Germany: Kultusministerium des Landes Nordrhein-Westfalen; Auswärtiges Amt der Bundesrepublik Deutschland; Hessischer Minister für Erziehung und Volksbildung; Stiftung zur Erforschung der Spinalen Kinderlähmung und Multiplen Sklerose.

Italy: Istituto Superiore di Sanita, Roma.

Norway: Norges Almenvidenskapelige Forskningsfond.

U.K.: Mental Health Research Fund, London.

U.S.A.: Rockefeller Foundation grant, administered by Columbia University, New York.

U.S.S.R.: Academy of Sciences.

of the Symposium with the problem of size of the conference. This meant finding a happy medium between an unwieldy convention, which, because of size, would strangle discussion, and a Symposium, which of necessity would limit the numbers of those attending. There is no real solution to this problem, and there were undoubtedly omissions of many who should have attended. We hope, however, that the Proceedings of the conference will transmit to the reader not only all the essential information which was presented during the scientific sessions, but also something of the excitement and intellectual pleasure which accompanied the exchange of ideas, and the probing of each other's minds.

New York
Birmingham
May, 1955

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PART I

**Morphological and Functional Ontogeny
of the Central Nervous System**

Some Aspects of the Early Development of the Nervous System

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I. Introduction

There is a most extensive literature devoted to one or other of the many aspects of the developmental history of the nervous system. Much of this literature is widely scattered in embryological, neurological, anatomical and general biological journals, and there have been few attempts to survey the whole field of the embryology of nervous tissues. On the purely descriptive side there are the classical accounts of the development of the human brain given by Tiedemann (1) and by His (2). More recently Hochstetter (3) has given an invaluable description, with numerous most useful illustrations, of the embryology of the brain in man, and Barbé (4) has also published a volume, of indifferent merit but containing some useful information, on the same subject. Krabbe (5) has also produced a series of volumes on the development of, chiefly, the external configuration of the brain in a number of different vertebrates. On the histogenesis of nervous tissue there are the volumes by Held (6) and by Cajal (7) and the material collected in the first part (the only one so far published) of the fourth volume of the von Möllendorff *Handbuch* (8). The extensive literature on the experimental embryology of the nervous system has not been brought together in an integrated fashion. Monographs by Detweiler (9) and by Hörstadius (10) deal with certain aspects of this important field and most of the general books on experimental embryology (as 11–20) give relatively detailed accounts of the early development of the neural epithelium. There are also available more or less comprehensive accounts of the development of behavior (21–33). Finally, as an introduction to the primary literature, there are a number of review articles dealing with certain, usually restricted, aspects of the development of the nervous system (24–32).