

# SECOND EDITION

REVISED AND ENLARGED

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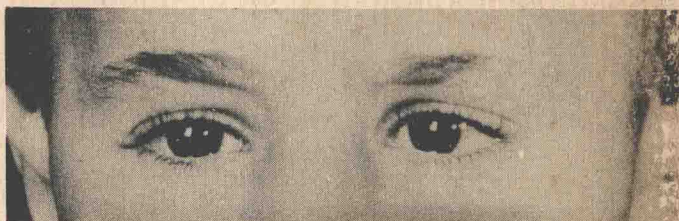
## IMPORTANT CHANGES IN THIS SECOND EDITION:

• The chapter on CHARACTERISTICS OF THE EXTRAOCULAR MUSCLES has been rewritten to emphasize the myopathies.

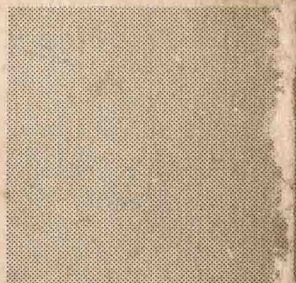
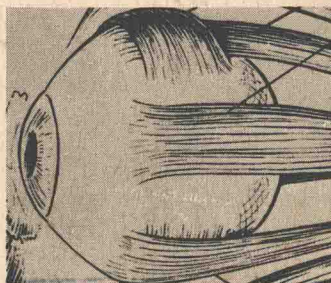
• The section on the cerebellum has been expanded to cover recent advances in the recognition of anatomic and functional localization in this structure and the ocular motor counterparts of cerebellar disease.

• Internuclear ophthalmoplegia has been treated in considerable more detail in view of its importance as the major ocular manifestation of multiple sclerosis and in view of the recognition of a unilateral variety that is caused by vascular disease.

• A short section has been added on the enigmatic phenomenon of skew deviation.



# NEUROLOGY OF THE OCULAR MUSCLES



CHARLES C THOMAS • PUBLISHER  
Springfield • Illinois

# Neurology *of the* Ocular Muscles

SECOND EDITION

*By*

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*Springfield • Illinois • U.S.A.*

CHARLES C THOMAS · PUBLISHER  
BANNERSTONE HOUSE  
301-327 East Lawrence Avenue, Springfield, Illinois, U.S.A.

*Published simultaneously in the British Commonwealth of Nations by*  
BLACKWELL SCIENTIFIC PUBLICATIONS, LTD., OXFORD, ENGLAND

*Published simultaneously in Canada by*  
THE RYERSON PRESS, TORONTO

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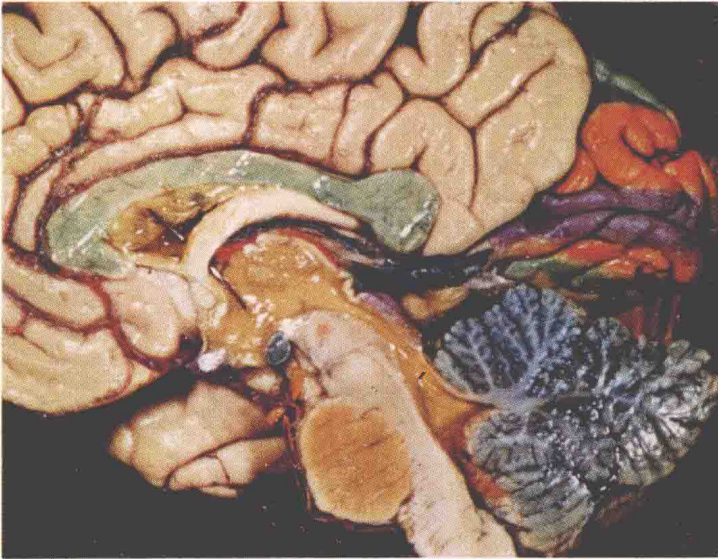
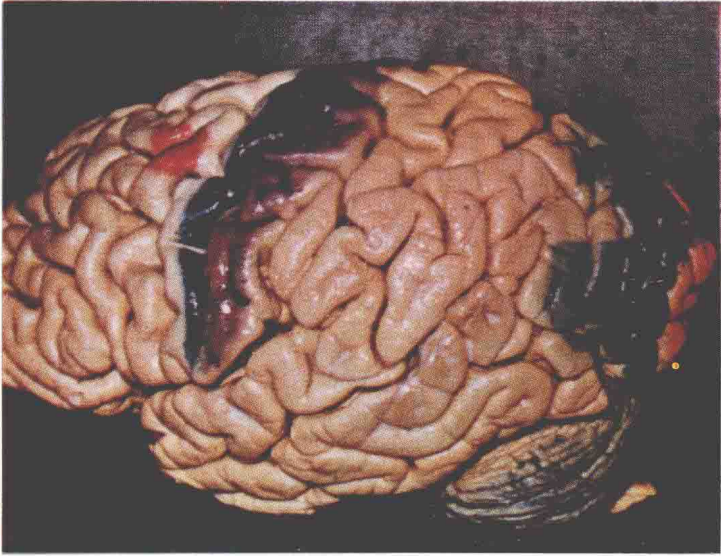
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Library of Congress Catalog Card Number: 56-9107

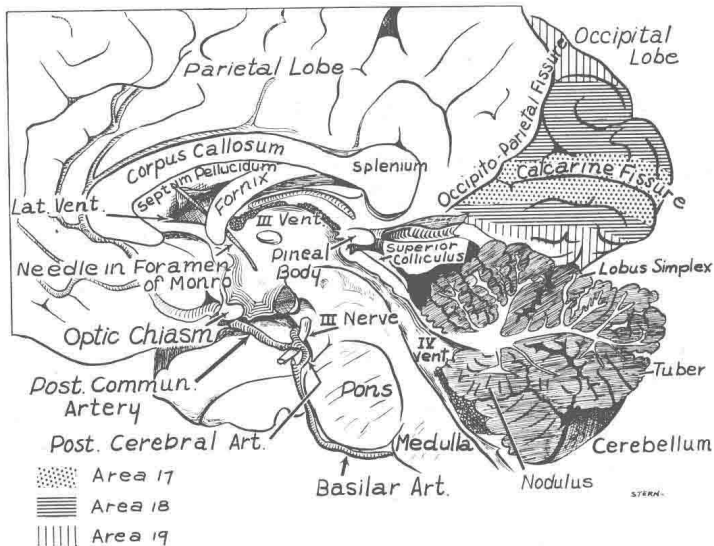
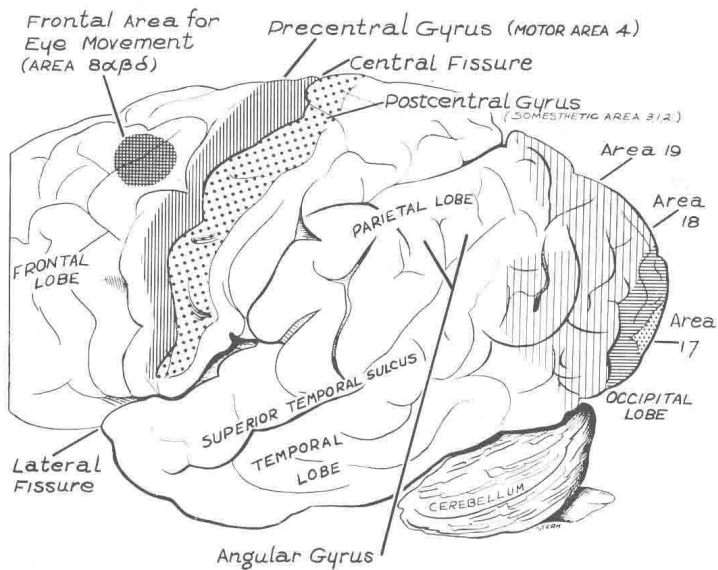
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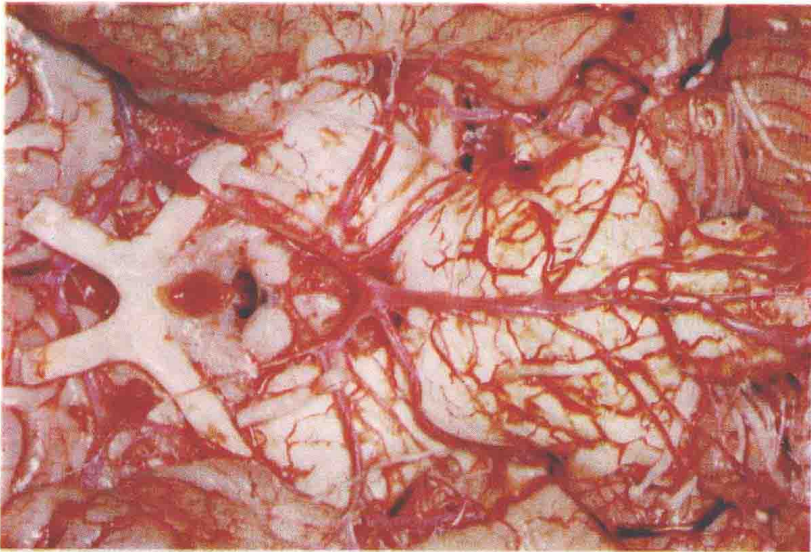
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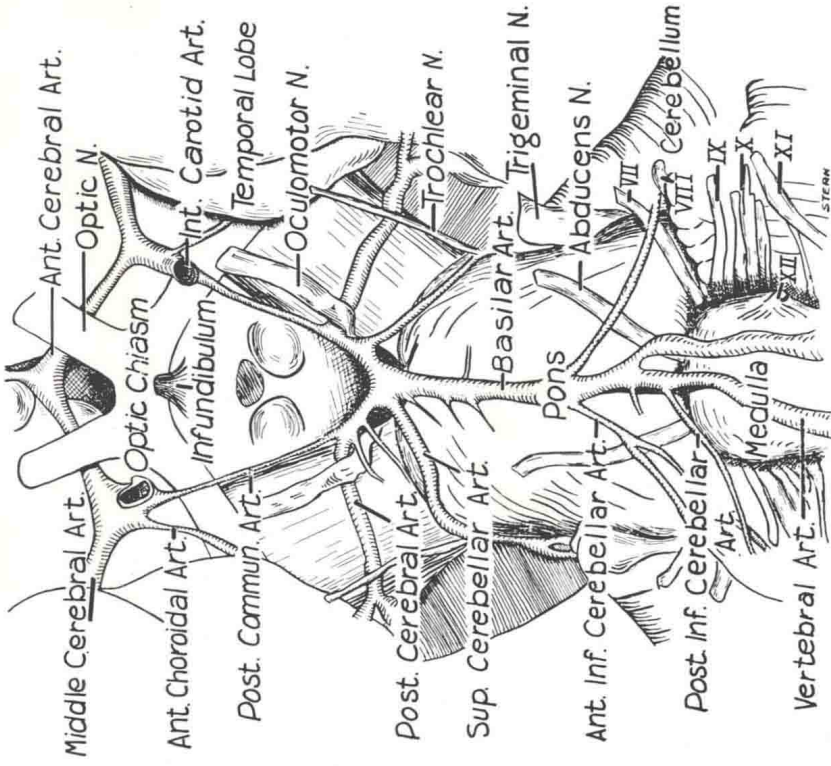


Formalin fixed brain which has been tinted to show pertinent structures on lateral surface of cerebrum (*upper picture*) and on medial surface of cerebrum, brain stem, and cerebellum (*lower picture*).





Base of brain illustrating arteries, nerves, and associated structures. The specimen was a normal brain removed at autopsy. It was not injected or otherwise treated.



## PREFACE TO SECOND EDITION

REVISION of a text is questionable practice, for the continuous and the orderly presentation is often lost with subsequent additions and graftings. Moreover, additions are so much easier to make than deletions that the original text must eventually lose its brevity. As anyone who has attempted to write must know, the problem is not what to include but what not to include; hence the increase in volume.

Thus, this second edition is presented with some misgiving. However, the recent upswing of interest in neuro-ophthalmology among students, the gracious insistence of the publisher, and valuable suggestions from numerous correspondents left little alternative. It is only hoped that an awareness of some of the pitfalls of revision may have mitigated their evils.

Aside from additions to the text compounded from the recent literature and from the author's experience, the organization has been considerably changed in places where this seemed expedient. Thus Chapter I of the first edition has been rewritten to emphasize the myopathies and re-set as Chapter III of the second edition. The section on the cerebellum has also been expanded to cover the recent advances in the recognition of anatomic and functional localization in this structure and the ocular motor counterparts of cerebellar disease. Internuclear ophthalmoplegia has been treated in considerably more detail in view of its importance as the major ocular motor manifestation of multiple sclerosis and in view of the recognition of a unilateral variety that is caused by vascular disease. A short section has been added on the enigmatic phenomenon of skew deviation.

An energetic attempt has been made to effect judicious deletions, but this was found difficult and only minor trimmings were accomplished. A section on the accommodative mechanism was again purposely omitted for, although accommodation has interesting physiologic implications and considerable ophthalmologic importance, it has only minor application in the neurologic field to which this little book is dedicated.



As in the original text the author has taken full liberty in the selection of subjects to be emphasized or to be omitted. In this there is inevitably a strong personal bias and lopsided reference to the author's interests and experiences. Only by this indulgence could the book escape being an uncritical and impersonal catalogue. Whenever pertinent, the work of others is cited so far as it is known to the author, and whenever controversial opinions are given, the source of information is presented by reference numbers.

## PREFACE TO FIRST EDITION

THIS TEXT, an outgrowth of several years' postgraduate teaching in ophthalmology, attempts to correlate the clinical manifestations of disturbances of the ocular motor system with its neuroanatomic and neurophysiologic architecture. The familiar truism to the effect that clinical findings can be properly interpreted only with a knowledge of anatomic structures and physiologic principles is nowhere more cogent than in the case of the ocular muscles. The control of normal ocular movements is far from simple. Not only is each eye motivated by six extraocular muscles, each of which is acted upon by stimuli arising from numerous sources and traversing different pathways, but the two eyes are precisely coordinated in their movements. Furthermore, the action of the extraocular muscle is coordinated with the muscles within the eye, with those of the lids, and with those controlling head movements. Disease processes add a further host of variables all of which can add up to a confusing picture for the clinician who is expected to arrive at an adequate diagnosis after a relatively brief examination. This text aims to resolve this confusion, in some measure, by presenting the physiologic and anatomic bases for the ocular motor disturbances as indissociable from the clinical manifestation.

The data in this text are arranged according to objective signs rather than disease entities. More than most specialties, neuro-ophthalmology is concerned primarily with localization of disease and only secondarily with the nature of the underlying process. This placing of emphasis on the topographic analysis of signs and symptoms is contrary to the usual approach of the clinician. Charged with the responsibility of therapy, the latter customarily aims to arrive at an etiologic diagnosis as rapidly as possible. As a result, texts in medicine are arranged according to disease entities rather than signs and symptoms. But the clinical manifestations of disturbances of the ocular motor system vary more with the site of the lesion than with the nature of the lesion and the neuro-ophthalmologist is, more often than not, charged with the respon-

sibility of localization only. The chapters in this text are therefore so arranged as to emphasize analysis of localizing signs and symptoms, and little or no space is given to treatment.

The extent to which a systematic presentation is possible on this basis must of course depend on the information available. In correlating the data one finds oneself in the ambiguous position of simplifying in the interests of lucidity and yet being critical of simplification in such a complex field as the ocular motor system. Accordingly, I have attempted to follow a course midway between dogmatism and nihilism, avoiding on the one hand a simplification that is unjustified by the data and on the other hand a skepticism that maintains that because some of our concepts will have to be altered in the future, all our present conclusions are therefore invalid. An effort has been made to set forth fairly the state of present knowledge of the clinical physiology of the ocular motor system and the conclusions that can be safely drawn from the facts available at the present time.

It is hoped that this text will be useful to ophthalmologists and neurologists and, above all, to those students of whatever branch or degree of training who are being inducted into this specialty within a specialty and who wish to have a comprehensive guide and outline at their command.

## ACKNOWLEDGMENTS FOR SECOND EDITION

FOR THE REVISION, as for the original text, my indebtedness is widespread and much of it indirect. Since the revision is largely based on the clinical material which I have had occasion to see and to study, my first indebtedness is to the patients who have tolerated examinations that often served the examiner's interests more than their own. I similarly have collective indebtedness to a group of loyal and thoughtful colleagues who have provided me with a wealth of "interesting cases" to study.

For more specific acts of service in the revision of this book, I have particular debts. Messrs. Charles C Thomas and Payne Thomas, as publishers, have facilitated my part in an exemplary manner; it has been a pleasure to work with them. Dr. David D. Donaldson provided the colored photographs for the Frontispiece and Dr. Sheldon D. Stern made the corresponding black and white drawings. The excellence of these preparations speak for themselves. For the bibliography, typing, proofreading, and endless details, I have had the assistance of Mr. Charles Snyder, Dr. Harvey A. Lincoff, Misses Therese Ecker, Sheila Gray, and Mary North.

D. G. C.



## ACKNOWLEDGMENTS FOR FIRST EDITION

THE INSPIRATION for writing this book is due in large measure to the students who patiently sat through the formative lectures. For their apparent interest and many helpful suggestions I am heavily indebted. The substance of the book has been taken from the available literature and compounded with the experience generously called the author's but in reality the experience of many persons, recognized and unrecognized, who have molded his opinion. The substance taken from the literature I have attempted to acknowledge by appropriate references throughout the text; the help of many who have made equivalent, albeit less tangible, contributions that cannot be directly referred to in the text, I can only acknowledge collectively but nonetheless with deep personal feeling.

For participating in the preparation of the monograph, I have certain specific obligations: to Dr. Mark Singer of the Department of Anatomy at the Harvard Medical School for several cross sections of the normal midbrain; to Dr. Charles Kubik of the Department of Neuropathology at the Massachusetts General Hospital for several neuropathologic specimens; to Dr. Frederick H. Verhoeff, my predecessor at the Howe Laboratory of Ophthalmology, for his criticisms of an earlier draft of the text; to Mrs. Irene M. Kinsey for proofreading; and to Miss Jeanette Loessl, librarian at the Howe Library of Ophthalmology, for her assistance in the compilation of the references.

D. G. C.

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