

1891

NEURO-OPTHALMOLOGY — Second Ed.



THOMAS

NEURO—OPHTHALMOLOGY

By

DONALD J. LYLE, B.S., M.D., F.A.C.S.

Professor and Director of the Department of Ophthalmology

College of Medicine, University of Cincinnati

Director of Ophthalmologic Service at Cincinnati General Hospital

Dunham Hospital, Drake Hospital, Children's Hospital

*Attending Ophthalmologist to Good Samaritan Hospital
and Christ Hospital*

*Chief Clinician, Ophthalmologic Service Outpatient Department
Cincinnati General Hospital*

*Consulting Ophthalmologist to the Children's Convalescent Home
Cincinnati, Ohio*

Senior Consultant to Veterans Hospital, Dayton, Ohio



CHARLES C THOMAS • PUBLISHER

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

This monograph is protected by copyright. No
part of it may be reproduced in any manner
without written permission from the publisher.

Copyright 1954, by CHARLES C THOMAS · PUBLISHER

First Edition, First Printing, 1945
First Edition, Second Printing, 1947
Second Edition, First Printing, 1954

Library of Congress Catalog Card Number: 54-10788

Printed in the United States of America



NEURO-OPHTHALMOLOGY

PREFACE

“IN RECENT YEARS the ophthalmic surgeon, the earliest surgical specialist, and the neurosurgeon, the latest, have from opposite directions come to meet at the barrier of the optic foramen—each somewhat hesitant to trespass on the other’s field of work. They, however, have much to learn from one another and between them an answer should be forthcoming to the moot questions.”¹

“The ophthalmic surgeon because of his ability to restore sight to the blind holds a high position in popular esteem. But ophthalmologists have traditionally restricted their surgical field to the orbit and have not ventured to pursue to their source the disorders of vision whose causes lie within the skull. Had they so pursued the source of choked disc or the source and causes of the primary optic atrophies, they might well enough have long preceded the neurosurgeon in those tasks which permit him to share in the gratifying occupation of restoring vision.”²

I know of no better introduction to the second edition of this book than to quote these two very appropriate passages from the writings of Harvey Cushing.

Though neuro-ophthalmology was generally neglected by the ophthalmologist it has gained great impetus in the last few years as witness the current programs, discussions, papers and books on the subject. The ophthalmologist has awakened to the fact that the eye is a projection of the brain which has perforce moved toward the surface in order to contact light and perceive images of the outer world. He also has taken cognizance of the fact that the blood supply and drainage is also by way of the cranial cavity. He is aware that the eye is frequently influenced by, and reflects, the various affections of the central nervous system.

Although several excellent treatises on neuro-ophthalmology have been published since the first edition of this book, I feel that certain phases of this comprehensive subject should be further stressed or discussed more in detail, together with recent advances in investigation, and clinical concepts.

In this edition basic knowledge of the subject is further amplified. I feel that pertinent data concerning the anatomy, with histologic detail when necessary and with outline of the normal function of these structures, is imperative for better understanding.

This should be supplemented by a knowledge of pathologic processes, with histo-pathologic studies when necessary, and with detailed investigation of the dysfunction produced. Presenting the material in this manner will be the endeavor throughout this book.

To many, I am indebted and deeply grateful. Soon after the first edition was

¹ Harvey Cushing and Louise Eisenhart: *Meningiomas*. Springfield, Charles C Thomas, 1938, p. 283.

² Harvey Cushing: *Intracranial Tumors*. Springfield, Charles C Thomas, 1932, pp. 69-70.

published Percival Bailey suggested improvements for a second edition, and with his usual painstaking detail noted the changes he would suggest. These suggestions have been carried out. Frank Mayfield and his associates, Edward Lotspeich and Curwood Hunter, have furnished clinical material and investigative help in abounding and continuous amount. A number of the illustrations are from their cases.

Joseph Evans has granted me many privileges in the Division of Neurosurgery. Many of the new illustrations are from his division. I have profited by histopathologic studies with Mark Scheinker and have used illustrations from his publications. Alphonse Vonderahe continues his help as he did with my first effort. Many of the old illustrations were culled from his collection. Howard McIntyre has provided a constant source of knowledge and material.

Joseph Homan, Director of the Department of Medical Arts, has given unstintingly of his great ability toward improving the illustrations. Elsworth Cochran and other members of the department have continued their aid. Miss Beatrice Woods, Mrs. Nancy Burnham Johnson and Mrs. Margaret Cook have provided outstanding illustrations.

Indexing of over 3200 bibliographic references, begun by Mrs. Carmenina Tomassini was continued by Lynn Zipin. Mrs. Tomassini helped with translation.

Preparation of the manuscript for the second edition, begun by Mrs. Kathleen Allen, has been continued and finished by Miss Dorothy Roberts. I wish to thank Mrs. Robert C. Nelson for help with the index.

Once more it is my pleasure to acknowledge my gratitude to Charles C Thomas and efficient staff for continuing their friendly offices in the production of this second edition.

D. J. L.

CONTENTS

Chapter I

THE VISUAL SYSTEM—THE RETINA	3
Embryology	3
Anatomy	5
Physiology	8
Clinical Application	10

Chapter II

THE VISUAL SYSTEM—THE OPTIC NERVE	13
Structure	13
Papillitis	17
Optic Neuritis	17
Retrobulbar Neuritis	20
Toxic Amblyopia	26
Papilledema	32
Optic Atrophy	36

Chapter III

THE VISUAL SYSTEM (continued)	
Optic Chiasm	41
Optic Tract	45
Lateral Geniculate Body	48
Optic Radiations	49
Visual Field Studies	56

Chapter IV

THE VISUAL SYSTEM (continued) STRUCTURES OF THE VISUAL CORTEX AND ASSOCIATION TRACTS AND AREAS	62
Visuo-Sensory Area	69
Visuo-Psychic Areas	70
Higher Psychic and Association Areas	73
Hallucinations and Illusions	74
Cortical Lesions	76
Aphasias	77
Functional Affections—Hysteria, Neurasthenia, Malingery	80

Chapter V

THE OCULOGYRIC SYSTEM	88
Conjugate Eye Movements	88
Binocular Vision	89
Supranuclear Centers and Tracts	93
The Voluntary Oculogyric System	94
Horizontal Component	97

Vertical Component	103
Internuclear Component	106
The Involuntary (visuo-motor) Oculogyric System	109
The Reflex Proprioceptive (positional) Oculogyric System	115

Chapter VI

STRUCTURES OF THE MIDBRAIN AND BRAIN STEM CONCERNED WITH OCULAR

REFLEXES	122
Midbrain	122
Posterior Longitudinal Bundle	126
Light Reflexes	132
Emergency Light Reflexes	134
Blinking Reflexes	134
Fixation Reflexes	136
Accommodation and Convergence	136
Vergence Affections—Disjunctive Lesions	136

Chapter VII

MOTOR NERVES OF THE EYES	149
Oculomotor Nucleus and Nerve	150
Trochlear Nucleus and Nerve	162
Abducens Nucleus and Nerve	163

Chapter VIII

THE SENSORY NERVE OF THE EYE, ORBIT AND EYELIDS (TRIGEMINAL NERVE) ..	172
Anatomy (distribution)	172
Herpes Zoster Ophthalmicus	180
Marcus Gunn Phenomenon	185
Trophic Nervous System	186

Chapter IX

THE MOTOR NERVE TO THE EYELIDS AND BROW (FACIAL NERVE)	191
Anatomy (distribution)	191
Facial Paralysis	194
Intermediate Nerve of Wrisberg (parasympathetic)	196
Hunt's Syndrome	197

Chapter X

THE AUDITORY NERVES (ACOUSTIC AND VESTIBULAR)	200
Acoustic Division	200
Vestibular Division	201
Nystagmus	205
Vestibular	206
Ocular	211
Cerebellum	216

Chapter XI

THE AUTONOMIC NERVOUS SYSTEM	219
Anatomy (distribution)	219
Sympathetic Division	224
Parasympathetic Division	226
The Pupil	226
Argyll Robertson Pupil	231
Holmes-Adie Tonic Pupil	232
Horner's Syndrome	233
Claude Bernard's Syndrome	234
See Chapter VIII for Trophic Nervous System	
See Chapter IX for Parasympathetic Nerve of Wrisberg	

Chapter XII

THE ARTERIAL VASCULAR SYSTEM OF BRAIN AND EYE	240
Anatomy (distribution)	240
Vascular Disturbances	252
Arteriosclerosis	253
Atherosclerosis (Atheroma)	253
Retinopathy in Arteriosclerosis	262
Arteriolar Sclerosis in Hypertension	263
Malignant Hypertension	265
Renal Retinopathies	268
Diabetic Retinopathies	272
Other Types of Vascular Involvement	272
Hemorrhage	277
Thrombosis	282
Embolism	290
Aneurysm	294

Chapter XIII

THE VENOUS VASCULAR SYSTEM OF BRAIN, EYE AND ORBIT	307
Anatomy (distribution)	307
Venous Sclerosis, Thrombosis and Hemorrhage	315
Cavernous Sinus Affections	320

Chapter XIV

THE CEREBROSPINAL FLUID SYSTEM OF THE BRAIN	325
Anatomy (distribution)	325
Hydrocephalus	332
Porencephaly	338

Chapter XV

MENINGITIS AND BRAIN ABSCESS	342
General Pathology	342

Tuberculous Meningitis	345
Meningococcic (epidemic) Meningitis	347
Purulent Meningitis	347
Syphilitic Meningitis	349
Other Types of Meningitis	351
Chiasmatic Arachnoiditis	353
Chronic Leptomeningitis	357
Brain Abscess	357
 <i>Chapter XVI</i>	
ENCEPHALITIS	362
Purulent Encephalitis	362
Nonpurulent Encephalitis (lethargic)	362
Encephalomyelitis	365
Toxoplasmic Encephalitis	366
Encephalopathies Including Lead and Alcohol	368
Superior Hemorrhagic Encephalitis	370
 <i>Chapter XVII</i>	
THE DEMYELINATING DISORDERS	376
Multiple Sclerosis (Disseminated Sclerosis)	376
Diffuse Periaxial Encephalitis (Schilder)	383
Neuromyelitis Optica (Devic)	385
Acute Disseminated Encephalomyelitis	386
 <i>Chapter XVIII</i>	
SYPHILIS OF THE CENTRAL NERVOUS SYSTEM	389
Meningo-Vascular Syphilis	389
Tabes Dorsalis	394
General Paresis	396
Gumma or Granulomata	397
 <i>Chapter XIX</i>	
CLINICAL DIAGNOSIS OF INCREASED INTRACRANIAL PRESSURE	400
Structures Involved	400
Tentorial Herniation	403
 <i>Chapter XX</i>	
EYE MANIFESTATIONS OF HEAD INJURIES	419
Concussion	419
Contusion	422
Laceration	423
Compression	425
Hemorrhages	425
Pupillary Symptoms	427

Conjugate Deviation of Eyes	428
Cerebral Localization	429
Skull Fractures	431
Complications	434
Convalescence and Sequelae	435

Chapter XXI

TUMORS OF THE RETINA	438
Retinoblastoma	439
Secondary Retinal Involvement from Melanoma, Carcinoma and Sarcoma	443
Phakomatoses	450

Chapter XXII

TUMORS OF THE OPTIC NERVE	455
Glioma	455
Meningiomas (Endotheliomas)	457
Neurofibromatosis—von Recklinghausen	459
Tumors of the Orbit	462

Chapter XXIII

INTRACRANIAL TUMORS	465
General Symptoms	465
Local and Focal Symptoms	467
Glioma	467
Meningiomas	472
Vascular Tumors	481
Pituitary (Hypophyseal) Tumors	484
Craniopharyngioma	492
Cholesteatoma and Chordoma	496
Pinealoma	496
Tumors of the Cerebral Hemispheres	498
Frontal Lobe	499
Temporal Lobe	501
Parietal Lobe	505
Occipital Lobe	505
Corpus Callosum	508
Thalamus	510
Lateral Ventricles	511
Third Ventricle	514
Fourth Ventricle	518
Midbrain	519
Pons	521
Cerebellum	521
Cerebellopontine Angle	525

Cranial Nerves	527
Infrequent and Metastatic Tumors	529
<i>Chapter XXIV</i>	
SYNDROMES WHICH INCLUDE EYE SYMPTOMS	533
Aphasic Syndromes	533
Foster Kennedy Syndrome	535
Meningioma Syndromes	538
Syndrome of the Pituitary (Hypophyseal) Adenoma	541
Carotid Syndrome	543
Chiasmal Syndrome	543
Cavernous Sinus Syndrome	543
Syndrome of the Epithalamus (Pineal)	547
Syndrome of the Hypothalamus	547
Syndrome of the Posterior Thalamus	549
Syndrome of Paralysis of Lateral Gaze	549
Syndrome of Dissociation of Lateral Gaze	552
Syndrome of Paralysis of Vertical Gaze	557
Central Tegmental Syndrome	557
Unilateral Tegmental Syndrome	559
Pontine Syndromes	562
Cerebellopontine Angle Syndrome	564
Sympathetic Syndromes	567
APPENDIX—HISTOLOGY	573
Cerebral Cortex	573
Retina	575
Neuroglia of the Brain	575
Neuroglia of the Retina	576
Cytology	577
Pathologic Histology	578
Neuronal Reaction	578
Reaction of Pigment Epithelium of the Retina	579
Neuroglial Reaction	579
Vascular Reaction	580
Cerebrospinal Fluid Reaction	581
INDEX	583

NEURO-OPHTHALMOLOGY

CHAPTER I

THE VISUAL SYSTEM—THE RETINA

IN THE lowest forms of animal life unicellular or multicellular organisms have the faculty, localized or scattered throughout the entire protoplasm, of sensitivity to light. The amoeba, when placed in a bright light with an adjacent area of darkness, will project its pseudopodia and, upon finding the dark area which corresponds more to its habitat, move into it. The earthworm, among other dark-adapted organisms, possesses the same expression of negative phototropism. Higher forms increasingly localize and develop the response to light perception in certain surface areas or spots—other areas losing this faculty. Eyes of invertebrates may go so far as to develop surface plate, pit or cup formation even to the development of a lens system.

When the vertebrate level is achieved, the control of vision is shifted from the surface to the central nervous system. In lower forms of vertebrates the light penetrates the transparent surface and deeper tissues to reach the photoreceptors in the primitive central nervous system. As evolution proceeds pigment appears and size increases, necessitating the growth of the photosensitive portion of the central nervous system to the surface to meet the light which is unable to penetrate. This is the beginning of the primitive eye, the photoreceptor maintaining its association with the brain of which it is a part (1) (Fig. 1).

As evolution continues the flat boss or ocular plate is indented and cupped and becomes recessed in the head or fore end of the body. Further development constricts the cup margin, fills the chamber with transparent substance and the rim with a primitive lens. Over this the surface becomes transparent to form the cornea. Muscles develop outside the eye to move it to better position for vision and inside the eye to control the size of the pupil and the focus of the lens. Eyelids and other accessory structures are added along with further development of the retina in the interest of better vision.

Embryologic development follows a similar pattern. The development of the human eye, a good example of the vertebrate eye, proceeds through analogous stages. From the fore end of the fore brain the optic vesicle pushes out until it makes contact with the surface ectoderm. It then, having incited the formation of the lens vesicle from its surface contact, invaginates into a two-layered optic cup attached to the fore brain by a tube, the optic stalk, through which, later in development, the axons comprising the optic nerve will pass to the brain. The lens vesicle follows the formation of the optic cup and closely fills the cup margin. The inner layer of the optic cup develops into the layers of the retina from which the optic nerve fibers pass to the brain. The outer layer of the optic cup becomes the pigment layer of the retina (Fig. 2). The lens becomes solid by accretion and from it and the retina the primary vitreous forms. The cornea

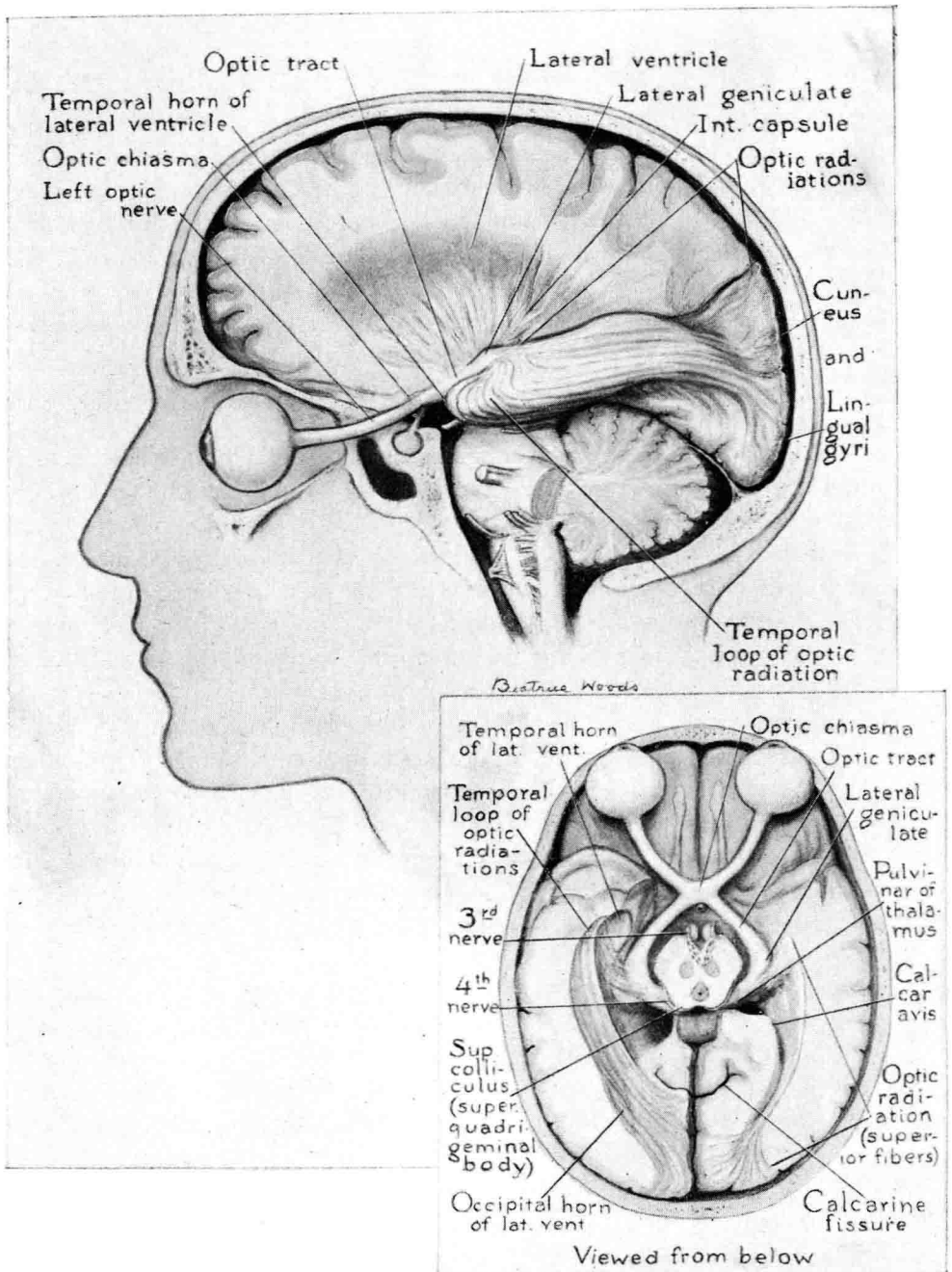


FIG. 1. Drawing of dissection of the brain demonstrating the visual system.

is derived from the surface ectoderm. In this manner the refractive media and the photoreceptive neurons are developed. Other tissues and structures form around this visual matrix to perfect its function (3).

It is necessary to remember that the human eye is the end organ or peripheral receptor, in this case photoreceptor, developed as a projection of the brain with which it is connected by an association tract, the optic nerve and its extensions. To this photoreceptor organ of neuro-ectodermal origin, other structures have been added to improve vision. Through development the primitive visual receptor has been recessed into an orbital cavity for protection and a refractive

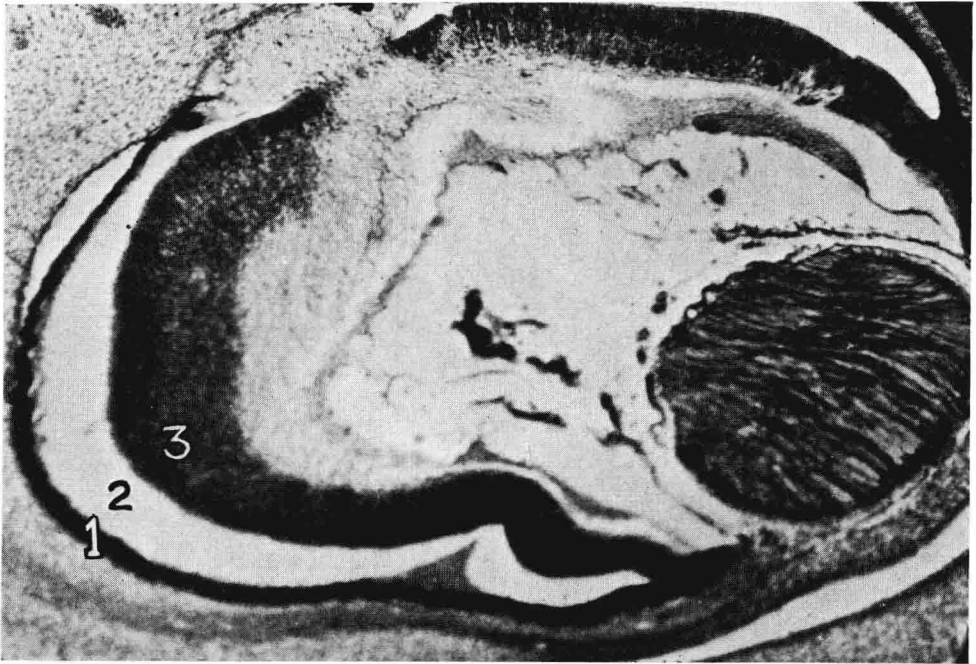


FIG. 2. Section of eye of human embryo (77 mm. early fetal period) showing closing of primary optic vesicle. 1. Outer pigment layer of optic cup. 2. Closing cleft of primary optic vesicle. 3. Inner differentiating retinal layer of optic cup.

system from somatic surface ectoderm has been developed and placed before it for better vision. This transparent media is composed of the cornea and lens, the aqueous and vitreous. Finally, the organ has been endowed with movement and the ability to focus. The walls have been given support and an elaborate blood supply has been developed from the mesodermal elements to provide exceptional nourishment. All of this to accomplish better vision.

The photoreceptors of the retina, those cells which react to light, form and color, are the rods and the cones (Fig. 3). These structures are based upon a thin external limiting membrane through which the rods send fibers to their nuclei in the outer nuclear layer. No space separates the cones from their