

## ANATOMY OF THE VASCULAR SYSTEM OF THE OPTIC DISC

by Douglas R. ANDERSON, M.D.



Douglas R. Anderson

**PHYSIOLOGICAL ASPECTS ON THE CIRCULATION  
IN THE OPTIC NERVE HEAD**

by Anders BILL, M.D.  
and Albert ALM, M.D.



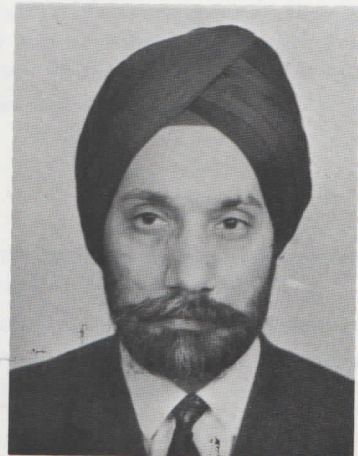
Anders Bill

From the Institute of Physiology  
and Medical Biophysics,  
University of Uppsala,  
Uppsala, Sweden

**PATHOGENESIS OF CUPPING OF THE OPTIC DISC**

by **Sohan Singh HAYREH**

Department of Ophthalmology  
University of Iowa, Iowa City  
Iowa, U.S.A.



Sohan Singh Hayreh

## CHOROIDAL CIRCULATION IN GLAUCOMA

by Milton BEST, M.D.  
and Miles A. GALIN, M.D.

From the Department of Ophthalmology  
of the New York Medical College.

Aided, in part, by USPHS Grant #HL 13660-08,  
USPHS Cont. #72-2115,  
the New York Ophthalmological Foundation, Inc.,  
Stella and Charles Guttman Foundation, Inc.,  
and Susan Greenwall Foundation, Inc.



Miles A. Galin



**STEREOPHOTOGRAMMETRIC AND OTHER METHODS  
FOR MEASUREMENTS OF THE OPTIC DISC**

by **C.E.T. KRAKAU**

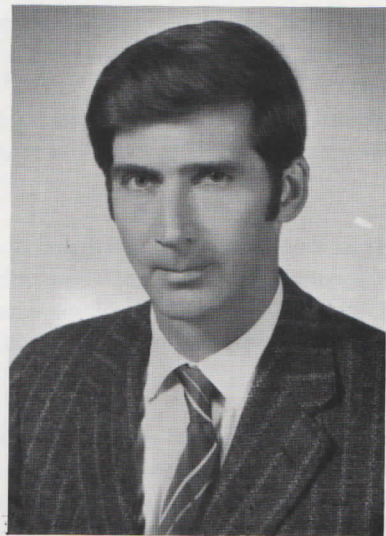


C.E.T. Krakau

## THE DISC IN CONGENITAL GLAUCOMA

by John HETHERINGTON, Jr, M.D.  
Robert N. SHAFFER, M.D.  
H. Dunbar HOSKINS, Jr, M.D.

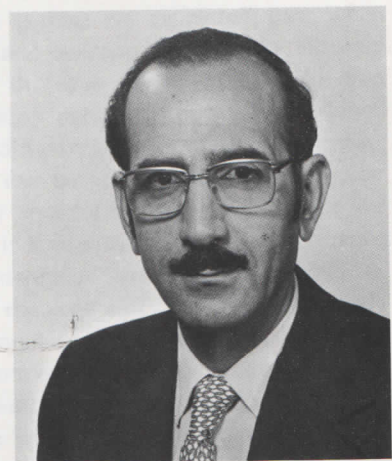
Kopf-klinikum Würzburg  
Universitätsklinik und Poliklinik  
für Augenkrankheiten  
8700 Würzburg  
Josef-Schneider-Straße 11



John Hetherington, Jr

## THE OPTIC DISC IN OPEN ANGLE GLAUCOMA

by Mansour F. ARMALY, M.D.



Mansour F. Armaly

**STUDIES OF THE CORRELATION OF VISUAL FIELD DEFECTS  
AND TISSUE CHANGES AT THE OPTIC NERVE HEAD  
IN CHRONIC OPEN ANGLE GLAUCOMA**

**by Gordon R. DOUGLAS  
Stephen M. DRANCE  
and Michael SCHULTZER**

From the Department of Ophthalmology  
and the Department of Mathematics,  
University of British Columbia

Supported partly by :  
Medical Research Council Grant,  
Number MT 1578  
National Health & Welfare Research Grant,  
Number 609-7-374



Stephen M. Drance



## TENSION TOLERANCE

by Wolfgang LEYDHECKER

From :  
University Eye Hospital Würzburg  
(Director : Prof. Dr. W. Leydhecker)



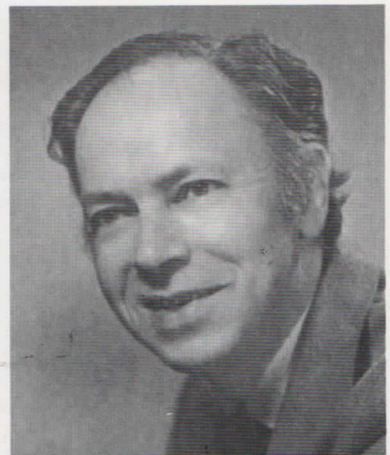
Wolfgang Leydhecker

**TONOMETERS - NEW DEVELOPMENTS**

by Robert A. MOSES, M.D.

From the Department of Ophthalmology  
and the Oscar Johnson Institute,  
Washington University School of Medicine  
St. Louis, Missouri

This work supported in part  
by Grant EY 000256,  
National Eye Institute,  
National Institutes of Health,  
Bethesda, Maryland, U.S.A.



Robert A. Moses

**BIOMETRY AND THE CLINICIAN**

**Introduction\* to the paper by R.F. Lowe**

**Primary angle-closure glaucoma : Biometry and the Clinician**

**Y DELMARCELLE (Liège)**

*"Car les quantités furent créées au commencement en même temps que la substance."*

J. KEPLER, 1596

\* Not presented at the Albi's Symposium

**PRIMARY ANGLE-CLOSURE GLAUCOMA :  
BIOMETRY AND THE CLINICIAN**

by Ronald F. LOWE, M.D.



Ronald F. Lowe



**ELECTRON MICROSCOPIC EXAMINATION  
OF THE TRABECULAR MESHWORK IN CAPSULAR GLAUCOMA**

by **Erick LINNER**  
and **Johannes W. ROHEN**

**E. LINNER**  
The Department of Ophthalmology,  
University of Umeå, Sweden  
**J.W. ROHEN**  
The Department of Anatomy,  
University of Marburg/Lahn, Germany



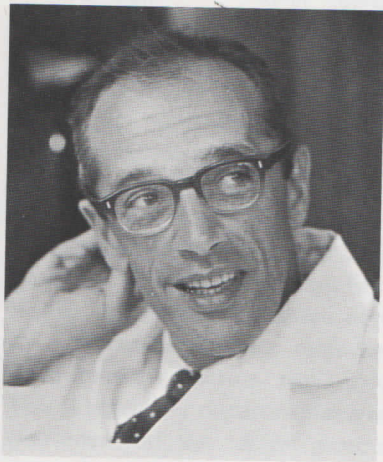
E. Linnér

**HYPERSENSITIVITY TO GLUCOCORTICOSTEROIDS  
AND PRIMARY OPEN-ANGLE GLAUCOMA**

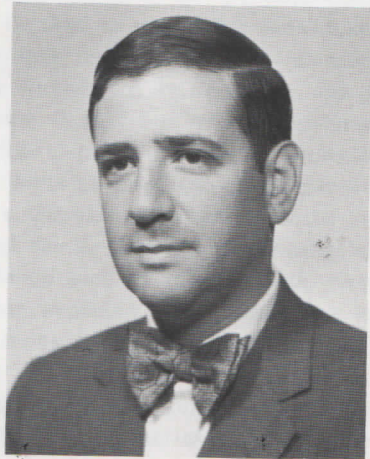
by Bernard BECKER, M.D.  
and Steven M. PODOS, M.D.

From the Department of Ophthalmology,  
Washington University School of Medicine,  
St-Louis, Missouri

Supported in part by research grants  
EY 00004 and EY 00336  
from the National Eye Institute,  
Bethesda, Maryland



Bernard Becker



Steven M. Podos

**OCULAR MICROTHERAPY  
ZERO ORDER DRUG RELEASE**

by Kenneth T. RICHARDSON, M.D.



Kenneth T. Richardson

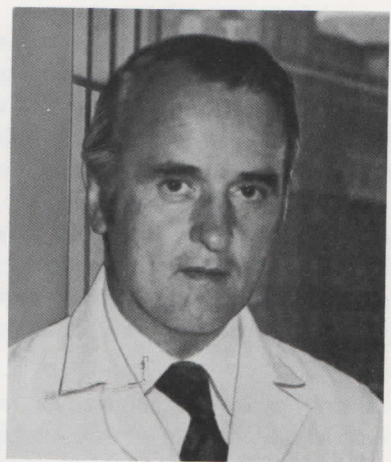
**THE PHARMACOLOGY OF THE ADRENERGIC  
THERAPY OF GLAUCOMA**

by Maurice E. LANGHAM

The pharmacology of the adrenergic therapy of glaucoma is discussed in this paper. The effect of adrenergic drugs on the aqueous humor outflow is reviewed, and the mechanism of action of these drugs is discussed. The effect of adrenergic drugs on the aqueous humor outflow is reviewed, and the mechanism of action of these drugs is discussed. The effect of adrenergic drugs on the aqueous humor outflow is reviewed, and the mechanism of action of these drugs is discussed.

The effect of adrenergic drugs on the aqueous humor outflow is reviewed, and the mechanism of action of these drugs is discussed. The effect of adrenergic drugs on the aqueous humor outflow is reviewed, and the mechanism of action of these drugs is discussed. The effect of adrenergic drugs on the aqueous humor outflow is reviewed, and the mechanism of action of these drugs is discussed.

The W.K. Kellogg Research Laboratories  
The Wilmer Institute  
The Johns Hopkins University School of Medicine  
Baltimore



Maurice E. Langham



THE NON-MIOTIC THERAPY OF OPEN ANGLE GLAUCOMA

by G.D. PATERSON, G. PATERSON  
and S.J.H. MILLER



From Glaucoma Unit  
Moorfields Eye Hospital  
High Holborn, London  
Department of Pharmacology  
Kings College, London

G. Paterson

primarily.  
ssure was  
17 weeks.  
y and this  
able. The  
that after  
sponse to  
ignificant  
erated by  
d. In the  
thectomy  
tients the  
h shorter  
versed in  
chemical  
ertension

chemical  
ous eyes  
y cannot  
strongly  
therapy  
en-angle

traocular

THE 1974 SURGERY OF GLAUCOMAS

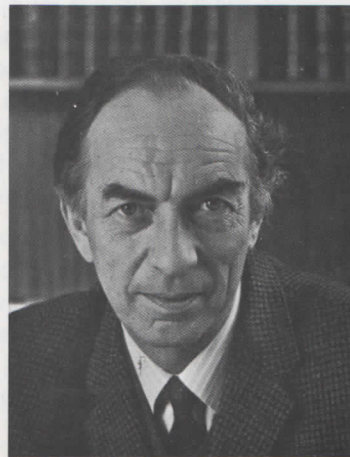
by Raymond ETIENNE  
Jacques CHARLEUX  
and Jean-Claude VILLON



Raymond Etienne

LASER TREATMENT OF GLAUCOMA

by E.S. PERKINS, M.D., Ph. D., F.R.C.S.  
and N.A.P. BROWN, F.R.C.S.



E.S. Perkins

Institute of Ophthalmology  
London

### LASER-TRABECULO-PUNCTURE (LTP)

by Prof. Dr. Med. Hugo HAGER

#### INTRODUCTION

The main indication for using laser trabeculopuncture is a reduction of intraocular pressure within the glaucoma treatment. The aim of this paper is to describe the procedure of laser trabeculopuncture and to discuss the results of the procedure. The aim of this paper is to describe the procedure of laser trabeculopuncture and to discuss the results of the procedure.

This procedure is performed by using a laser beam to create a hole in the trabecular meshwork. The aim of this procedure is to reduce the intraocular pressure.

A further indication for using this method is the treatment of glaucoma. The aim of this procedure is to reduce the intraocular pressure. The aim of this procedure is to reduce the intraocular pressure.

The aim of this procedure is to reduce the intraocular pressure. The aim of this procedure is to reduce the intraocular pressure. The aim of this procedure is to reduce the intraocular pressure.



Hugo Hager



**TRABECULOTOMY VERSUS MEDICAL TREATMENT  
IN CHRONIC OPEN ANGLE GLAUCOMA**

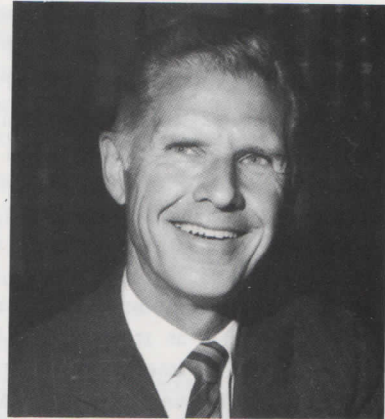
First results after 16 months follow up

by Ph. DEMAILLY  
L. PAPOZ  
and F. VALTOT



Ph. Demailly

21



R.N. Shaffer

## SUMMARY

*R.N. Shaffer* – The continued interest in the vascular supply of the optic disc is shown by the excellent papers of Anderson, Bill, Hayreh, Galin, Best and Drance. Our knowledge of the disc's anatomy and physiology increases but we still have no definite explanation of the specific disorder responsible for the characteristic nerve-fibre defect seen in glaucoma. Ischaemia certainly seems to be the basic cause of damage. How this ischaemia is produced at the relatively low pressures found in open angle glaucoma is not yet understood.

To prevent damage to the optic nerve therapy should ideally be directed to improving its blood supply. The systemic blood flow can only be influenced by improving the general circulation. Usually this is not possible. Consequently we are left with control of intraocular pressure as our best method of improving nourishment of the optic papilla. This accounts for our apparent preoccupation with intraocular pressure. Dr. Leydecker summarizes the six significant factors, height of tension, duration of tension elevation, the stage of the glaucoma, the size of the excavation, the condition of the disc vessels, and the systemic blood pressure. Dr. Moses points out that none of the new tonometers are superior to the Goldmann tonometer.

The mechanisms by which resistance is increased in the exfoliation syndrome (glaucoma capsular) is described by Linner. In all cases with tensions above 30 mm Hg large amounts of exfoliative material is found in phagocytes in the trabeculum and in the inner wall of Schlemm's canal. The endothelial cells are thinner and the juxtacanalicular zone is thicker than in normals. The glaucoma is more severe than in chronic simple open angle glaucoma.

The mechanism of pressure elevation in angle-closure glaucoma is described by Lowe. His careful measurements confirm the forward position of the lens and the shallow anterior chamber characteristic of these eyes. He states that lens growth with ageing only, changes the chamber depth of 0.5 mm on the average.

The rapid cupping of the optic disc seen in anterior ischaemic optic neuropathy is discussed by Hayreh. It is questionable, in my opinion if the physiopathology of this cupping is the same as that seen in open angle glaucoma. It is probably analogous to the cavernous degeneration described by Schnabel following attacks of intraocular angle closure glaucoma. A good animal model has been described by



Hamasaki and Zimmerman. Alphachymotrypsin injected into monkey eyes gives a similar high rise of pressure with liquefaction of the nerve behind the lamina cribrosa which bows back producing a marked cupping. This seems different from the loss of glial elements producing cupping in open angle glaucoma. Bowing back of the lamina cribrosa is a late occurrence according to Goldmann.

In infants this loss of substance can produce cupping in a few weeks as shown by Hetherington et al. Normalization of pressure can completely reverse the cupping. There is no loss of neurons. This can be proven by normal fields performed when the child is old enough. Similar but less dramatic findings are found in older patients. This refutes the contention that the ophthalmoscope shows only late damage to the nerve. In truth, as stressed by Armaly both ophthalmoscopy and perimetry are important. Sometimes one, sometimes the other may demonstrate earlier changes. Personally I believe there is usually some increase in cupping before field loss can be demonstrated. The ophthalmologist must use tonometry, ophthalmoscopy, perimetry and good clinical judgement in his care of the glaucoma patient.

Documentation of changes in cupping is most important. It may be that Krakau's method of stereogrammetry will be the most sensitive way to document changes in cup volume. More available methods are serial stereophotography, and contact lens ophthalmoscopy with careful examination of the cup.

Fascinating differences are seen between the corticosteroid response of open angle glaucoma patients and normal controls. Becker and Podo's studies on the hypersensitivity of primary open angle glaucoma patients to glucocorticosteroids are fascinating. The significance of these findings in the etiology and treatment of the condition remains obscure.

The use of catecholamines in the medical treatment of open angle glaucoma is discussed by Langham. The action of a new  $\beta_2$  agonist, salbutamol, is described. Pressure is lowered but tachyphylaxis and hyperaemia discourages long term use. Similar findings were reported by Paterson and Paterson. They reported more promising results with the topical use of a sympathetic post-ganglionic blocking agent, guanethidine combined with epinephrine. Others in the group reported tachyphylaxis, hyperaemia and decreasing effectiveness with time.

An interesting long-term prospective comparison of the success of medical therapy of open angle glaucoma versus the use of trabeculectomy is being conducted by Demailly. The 16 months of follow-up to date is insufficient to present definite conclusions. His future findings will be of great importance. New surgical methods are presented. Hager describes the use of the laser to punch openings in the trabecular meshwork. This interesting method is still experimental. Most reports suggest that pressure reduction by this method is transient. Both Hager and Perkins and Brown agree that the laser can produce iridectomies. At present surgical iridectomy remains the preferred method.

Etienne and Charleux describe several relatively new surgical methods for control of open angle glaucoma. Their greatest enthusiasm is for trabeculectomy in which their statistical results have been outstanding. Trabeculectomized eyes are surprisingly quiet post-operatively and seldom have flat anterior chambers occurred. Time will tell if the success rate is higher and complication rate lower, with this or the other

operations described. They are also enthusiastic about iridectocycloretraction as advocated by Krasnov.

The total drainage of aqueous from the eye can be accomplished by one 12 micron opening. A 1 mm trephine opening is 1.000 micron ; a trabeculectomy is some 5.000 microns, but covered by one scleral flap. It is hard for me to call this "micro-surgery" even though performed through a microscope. Many operations have been devised for control of open angle glaucoma. High enthusiasm is expressed at first followed by disillusionment as long term results become available. I shall be both surprised and pleased if this is not true of many of these new "micro-surgical" methods. The quotation on wound healing remains true, "it is not so much the quality of the wound as the quality of the wounded".

With the exception of angle closure glaucoma, the basic mechanism of the pressure elevation and of the optic nerve vulnerability remains somewhat mysterious. It was agreed that this symposium had problems unsolved. However it had demonstrated areas of agreement and of disagreement among the experts gathered at Albi. It had pointed out new area for investigation. Most important, it had led to the cementing of international friendships and prepared the way for future cooperation in studying that fascinating disease... glaucoma.



# Addenda

- Stereophotographies, 469  
*Douglas R. Anderson, M.D.*
  
- Pneumatography : A new methodological approach to the analysis of  
intraocular pressure and aqueous humor dynamics in human eyes, 475  
*Maurice E. Langham, M.D.*