



# GLAUCOMA

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*Transactions of the Fourth Conference*  
*March 8, 9, and 10, 1959, Princeton, N. J.*

*Edited by*  
FRANK W. NEWELL, M.D.  
DEPARTMENT OF SURGERY (OPHTHALMOLOGY)  
THE UNIVERSITY OF CHICAGO  
CHICAGO, ILL.

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## THE JOSIAH MACY, JR. FOUNDATION CONFERENCE PROGRAM

DURING THE PAST fifteen years the Josiah Macy, Jr. Foundation has organized more than twenty conference groups, each group meeting for at least two days annually over a period of five or more years. Each meeting is limited to twenty-five participants (members and guests), selected to represent a multidiscipline approach to some urgent problem in the field of medicine and health. The goal of this conference program is the promotion of communication, the exchange of ideas, and the stimulation of creativity among the participants. The purpose of the publication of the Transactions of the meetings is to share, as far as possible, the conference process with a larger audience than could participate personally in the discussions.

These conferences provide an opportunity for informal give and take among the participants. To further this purpose the number of presentations planned for each day is generally restricted to one or two. The member, or guest, selected to give such a presentation is requested not to "read a paper," but rather to highlight, in an informal manner, some of the more interesting aspects of his or her research, with the expectation that there will be frequent interruptions by participants in the form of questions, criticism, or comment. Such interruptions during the course of a presentation are encouraged and form an essential part of the "group interchange."

The conference program has always been viewed by the Foundation as an experiment in communication in which there is room for improvement and need for frequent reappraisal. Sufficient experience has already been gained to justify the conclusion that this type of conference is an effective way of improving understanding among scientists in medicine and allied disciplines, of broadening perspectives, of changing attitudes and of overcoming prejudices. The further conclusion has been reached, as the result of this experiment, that the major obstruction to understanding among scientists lies in the resistance of human attitudes to change, rather than in difficulties of technical comprehension. Less extensive experience with non-scientists has indicated that the effectiveness of this type of conference is not limited to groups of scientists, but will function in any group meeting where more effective communication

is the primary goal. It is also clear that the same conference technique, with minor changes, is readily adapted to small international conferences.

The style of publication of the Transactions has aroused considerable interest and some criticism. The criticism has been directed primarily to editorial permissiveness which has allowed in the final text, in some instances, too many questions, remarks, or comments which, although perhaps useful during a heated discussion, seem out of context and interrupt the sequence of thought in the printed volume. A few have objected to the principle of publishing in this style and would prefer a depersonalized summary without interruptions.

The Foundation Staff and the Scientific Editors of these volumes welcome criticism and hope to profit thereby in increasing the usefulness of the Transactions to scientists and students of science in this country and abroad.

FRANK FREMONT-SMITH, M.D.

*Medical Director*

# THE FINE STRUCTURE OF THE NORMAL TRABECULAR APPARATUS IN MAN\*

LEVON K. GARRON

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MY PRESENTATION will concern itself with the electron microscopic appearance of the trabecular meshwork. The materials used in these studies were, in some instances, human eyes obtained immediately after surgical enucleation and, in other instances, eyes acquired as soon after death as possible. We have been interested in studying the fine anatomy of the trabecular tissue because of the obvious involvement of this area in glaucoma.

The histology of the trabecular meshwork has been well documented for over 60 years. In 1912, Salzmann (1) published his classic text on the anatomy and histology of the eye, summarizing everything that was known on the subject up to that time. Surprisingly little has been added to this knowledge until recent years. In 1956, Dr. Norman Ashton and his associates (2) published a very fine article on the histology of the trabecular meshwork, which I recommend.

The trabeculae have been described as being made up of the uveal meshwork, which is that portion bordering the anterior chamber and extending from the peripheral iris to the surface of the trabeculae, and the corneoscleral meshwork, which is the major portion of the trabeculae within the area delineated by the scleral spur, the end of Descemet's membrane, and the posterior aspect of Schlemm's canal. Histologists have told us that the only difference between the uveal fibers and the corneoscleral fibers is that the former lack an elastic layer. The corneoscleral fibers have been described as being four-layered structures: Innermost is the collagen core; this is surrounded by the elastic layer; a Descemet-like glass membrane, supposedly an extension of Descemet's layer of the cornea, covers the elastic layer; and outermost is the endo-

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\*This work was supported by U. S. Public Health grants B-1229 and B-1782.



thelium of the trabecular fiber. The trabecular meshwork is ring-shaped and in cross section is roughly triangular, the apex being at the end of Descemet's and Schwalbe's line and the base of the triangle extending from the innermost aspect of the scleral spur outward toward the sclera, just posterior to Schlemm's canal. The trabecular tissue extends circularly around the inner limbus and, of course, borders the angle of the anterior chamber. The total volume of the trabecular meshwork has been estimated to be in the neighborhood of 4 cu. mm.

The orientation of the trabecular fibers has been the subject of some controversy for the past 50 or 60 years. There are those who have visualized the trabecular structures as a series of fibers extending from the region of the scleral spur anteriorly to Descemet's layer of the cornea. At the present time, our concept is not too different from that described by Salzmann (1) and other workers early in this century. He stated that the collagen core in the trabecular meshwork was oriented circularly around the eye parallel to the limbus and to Schlemm's canal, with the fibers of the collagen core running circularly in the laminae. It is generally agreed that the size of the passageways through the trabecular sheets decreases as Schlemm's canal is approached, and that they are generally oval in shape with the long axis in a direction parallel to Schlemm's canal.

After studying some of our early electron microscopic sections of the trabecular tissue, we were struck by a number of findings which were at variance with the classical picture we had always accepted for the histology of the trabeculae.

At this point, I would like to review the histology of the region by showing some ordinary light microscopic sections. Figure 1 shows the cornea, the iris, the scleral spur, and the trabecular meshwork extending between the scleral spur and Descemet's layer or Schwalbe's zone. The trabecular meshwork is roughly triangular in shape. Aqueous diffuses through the trabecular meshwork from the anterior chamber to gain access to Schlemm's canal. Figure 2 shows the trabecular tissues in higher power and reveals the fact that the meshwork immediately adjacent to Schlemm's canal is somewhat denser than the remainder of the trabeculae. In 1901, Asayama (3) was the first to show that the outermost portion of the trabecular meshwork, that portion immediately adjacent to Schlemm's canal, was quite different in character from the remainder of the corneoscleral meshwork because of its density. This thin zone of tissue bordering Schlemm's canal we like to call the filtration tissue.

*Fremont-Smith:* Is it a real filter?