The Glaucoma Book
The Glaucoma Book

A Practical, Evidence-Based Approach to Patient Care
The gestational period for *The Glaucoma Book* has exceeded that of the African elephant (Loxodonta africana) whose pregnancy lasts an average of 660 days. The 2-year period from its conception to parturition has been filled with both pain and joy, similar to the human birth process. When two friends and colleagues decide to create a major textbook on glaucoma, it places a great strain not only upon them, but upon the ones that they love. Our wives, Sharma Schacknow and Griffen Samples, and our children Wesley Samples, Laura Samples, and Jeffrey Schacknow have shared with us our ups and downs, our late night phone calls, our unavailability for normal social functions, our thousands of e-mails to parts unknown and our happiness that this project has finally come to a wonderfully successful conclusion. No marriages were lost, no children abandoned. We dedicate this book with love to all of these family members who helped us maintain our mental equilibrium. We are back more fully in your lives. Hopefully, the copy of *The Glaucoma Book* that each family will have on the living room coffee table, will daily serve to remind each family that Paul and John have worked very hard to better the lives of our patients for whom they took an oath to serve and cure.

Paul Schacknow and John Samples
Putting together a comprehensive, multiauthored text is a daunting task. However, the benefits may justify the effort. Such is the case with regards to the present *Glaucoma Book*. It is not likely that many ophthalmologists (or others) will decide, at the end of a busy day, to pour themselves a cocktail, and settle into a comfortable chair with this large tome in hand, with the intent of reading it from start to finish. A pity. It would make several enjoyable and profitable days of good reading.

The text starts with comments by an individual who is strongly grounded in the fundamentals of being a good physician. Ivan Goldberg has used his brilliance, his wide international experiences and knowledge, and his commitment to assuring that physicians know their craft, to provide a penetrating perspective on ophthalmology today and tomorrow. *The Glaucoma Book* ends with commentaries by the editors, John Samples, a true physician/scientist, and Paul Schacknow, an experienced community-based clinician. Samples’ essay “What Really Causes Glaucoma?” nicely describes the leading theories underlying the cell biology of glaucoma. In “What Do We Know Now, What Do We Need to Know About Glaucoma?,” Schacknow offers an essay on some of the controversial ideas raised within the book and speculates on future research. The stage is set for comments by the world’s leading experts in the field of glaucoma, and their trainees, to deal with the issues raised by Goldberg: the final curtain closes with the difficult but valid idea that while we know a lot, and are knowing more, there is no substitute for observing clearly and pondering thoughtfully.

It is disturbing that half (or more) of the world’s people who have glaucoma never even get diagnosed; it is tragic that glaucoma is the leading cause of irreversible blindness in the world, when the overwhelming bulk of that misery could have been prevented by proper diagnosis and treatment. We are not clearly doing our job well; there is clearly much to learn and lots to do.

While it is not the traditional way physicians use large texts, ophthalmologists would do well to spend several hours by the fire with *The Glaucoma Book*. The people who would really benefit would be patients.

George L. Spaeth
Esposito Research Professor
Wills Eye Institute
Philadelphia, PA
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Preface

Do we really need another book about glaucoma diagnosis and management? There are probably several classic, fairly up-to-date, texts about glaucoma sitting on your bookshelf. Who would have the audacity to write a new text entitled “The” Glaucoma Book, as though it would be the one you would turn to first for definitive, pragmatic answers to questions about diagnosis and management of your patients? Not just a comprehensive academic work with evidence-based science and exhaustive bibliographies, but also an everyday, pragmatic guide for comprehensive ophthalmologists, optometrists, and resident physicians, who would look to it for answers to clinical questions while patients are being examined in their offices.

The Glaucoma Book has been written by physicians. Many of them are members of the American Glaucoma Society; all are either fellowship-trained glaucoma specialists, their current glaucoma fellows, and exceptional residents, optometric physicians, or experts on some special topics. These colleagues have large clinical practices and years of experience dealing with the everyday issues that confront eye physicians who manage glaucoma patients.

Our goal was to create both a clinically based book and an academic reference that would serve to bring the explosion of new glaucoma diagnostic techniques and therapeutic interventions to those doctors in the trenches who see the great majority of glaucoma patients. We invited not only “the usual suspects” from well-known academic institutions, whose names you are familiar with from the literature and international scientific congresses, but also community-based, real world ophthalmologists, who both know the latest science and also how to see 50 patients in a day while still delivering state-of-the-art care.

This book is nontraditional in several ways. We do not include a great deal of discussion on eye anatomy. We do have sidebar essays, inside of major chapters, that discuss important subtopics in greater detail. We have allowed the style to vary among manuscripts, some are more formal, with a large number of references, and some are more informal with a reflective or philosophical bent and few or no references. Photos, illustrations, and tables are sprinkled liberally throughout the book where most appropriate. The topic choices range from the conventional (e.g., open angle glaucoma, pigmentary dispersion syndrome) to those that have not previously appeared in a glaucoma textbook (e.g., medical-legal aspects of glaucoma care, doing community-based glaucoma research). The Glaucoma Book is intentionally idiosyncratic in its design.

We have allowed each author the space needed to discuss their assigned topic, so some chapters are longer than others. There is considerable overlap and redundancy in this multi-authored text. This repetition of ideas and facts, from different perspectives, adds strength to the volume. While some topics may be explored to different depths within different chapters, each chapter stands on its own and may be read without having a need to build upon a previous chapter. Cross-referencing of similar topics between chapters and sidebars is done within chapters.

The Glaucoma Book is divided into six sections, containing 92 chapters and 38 sidebar essays. Topics are presented in what seemed like a logical order. The book can be read from front to back or sampled intermittently as interesting patients present themselves in your practice. We did not censor our authors from expressing unconventional scientific ideas, as long as
they could present convincing arguments for their opinions. This book is not meant for glaucoma subspecialists who are surely familiar with most of the information it contains. (Of course, we hope that a few of them too will buy a copy!) Rather, the editors feel that we have created an informative, useful tool for the working ophthalmologists and the ophthalmologists in training on current thinking in glaucoma circles. This should ultimately benefit our glaucoma patients who place their trust in us for proper diagnosis and treatment.

Lake Worth, FL
Portland, OR

Paul Schacknow
John Samples
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Part I
The Basics
Chapter 1
Glaucoma in the Twenty-First Century

Ridia Lim and Ivan Goldberg

1.1 What is Glaucoma for the Twenty-First Century?

Our concepts of the glaucomas evolve as our understanding of disease processes increases, technology advances, and our treatment strategies become more sophisticated. Technology has always corralled our definitions and our understanding of the glaucomas; the challenge of this new century is to focus our progress for the direct benefit of our patients.

To understand and to modify where we are heading, we must know where we are now, and how we arrived here.

Since the time of Hippocrates, the glaucomas have mystified physicians. In the mid-nineteenth century, the truth began to emerge.1 The link with disc cupping followed Hermann von Helmholtz’s 1860s invention of the ophthalmoscope and Albrecht von Graefe’s observations. Thus, there arose the structural nerve head-based definitions: Glaucoma was considered a neurological disease. The association with raised intraocular pressure (IOP) occurred over several centuries but was boosted by improvements in tonometers between 1880 and 1910 (Table 1.1). Improved functional assessment established the mid-twentieth century triad definition: raised IOP with characteristic optic disc and visual field functional damage. As tonometry, perimetry, and optic disc structural evaluation have each advanced, significant developments in one area have emphasized that aspect of glaucoma. The most recent technological improvements in objective optic disc and retinal nerve fiber layer (RNFL) assessment have moved our focus once again to the underlying neurological consequences of this group of diseases. We must remember: Technological capabilities drive our definitions and concepts of the glaucomas and their management.

Most glaucomas are chronic and relatively slowly progressive; technological advances occur faster than we can evaluate them critically. In every area, there is continued exponential growth. This could lead us to lose sight of our first call as clinicians: All these advances are ultimately for the benefits of individual patients, for whom management strategies need to balance potential benefits against possible risks of harm. Understanding of a patient’s quality of life (QOL), independence, and personal dignity must also advance, so that progress has a meaningful human application. Physical, emotional, and financial considerations are part of this.

Currently, we define the glaucomas as an optic neuropathy (with multifactorial risk factors that include increased IOP, increasing age, and genetic predisposition) characterized by recognizable patterns of optic disc and retinal nerve fiber structural and visual field functional damage. Glaucomatous optic neuropathy is not the disease; it is the end-result of several as yet unidentified cellular disease processes. Unlike almost all other optic neuropathies, contour changes of the optic nerve head (“cupping”) with progressive loss of the retinal nerve fiber layer and associated functional deficits are features of the disease; this results from accelerated retinal ganglion cell apoptosis, initiated by damaging processes that target the axons of these cells as they leave the globe. Thus, the definition varies with the perspective of the definer: retinal ganglion cell apoptosis to a scientist, optic neuropathy to a clinician, and fear of blindness for a patient.

1.2 What Are the Challenges We Face in the Twenty-First Century and Beyond?

We have to meet the challenge to find those with glaucoma who are undiagnosed.

Population studies have yielded a wealth of data about glaucoma prevalence, incidence, and risk factors in Caucasian, Latino, African-American, Afro-Caribbean, Indian sub-continental, and Oriental populations (see Fig. 1.1). Second only to cataract, globally the glaucomas are the