

# Introduction of Paul Kaufman as the 2017 Jonas S. Friedenwald Awardee

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I am pleased to introduce Paul L. Kaufman, MD, as the recipient of the 2017 ARVO Jones S. Friedenwald Award. The common feature of many distinguished Friedenwald Award winners in the past, and in fact the key criterion for worthiness in receiving this most prestigious award, is the demonstration of the candidate's accomplishments in scientific ophthalmic investigation. Although many previous awardees have certainly demonstrated research excellence, Paul Kaufman is among the very few who have been fortunate to possess a most unusual ability that was seminal to Dr. Friedenwald himself, namely, the remarkable ability to perform distinguished research at the highest level in more than one ophthalmic subspecialty area. Jonas Friedenwald's multiple accomplishments in the area of glaucoma, including discoveries pertaining to aqueous secretion, disease pathogenesis, and tonometry and tonography, are by themselves worthy of distinction. But his work in corneal wound healing, optics (including the Friedenwald ophthalmoscope), histochemistry, and ophthalmic pathology (for which he literally wrote the book *Pathology of the Eye*, in 1929), are breathtaking lifetime accomplishments for one highly gifted individual. Paul, in more ways than one, is Friedenwald's modern-day successor in that his accomplishments are both deep and substantial in more than one ophthalmic area, specifically, aqueous humor dynamics, glaucoma, and accommodation/presbyopia.

Dr. Kaufman is a physician-scientist; he was trained as an ophthalmic clinician and glaucoma subspecialist at Washington University-Barnes Hospital (St. Louis, MO, USA) under the tutelage of Dr. Bernard Becker (a Friedenwald awardee). With a passionate interest in how the anterior segment "worked," and how it might be manipulated therapeutically, he then undertook a 2-year research fellowship in ocular physiology and pharmacology at the University of Uppsala, Sweden, with Dr. Ernst Bárány (Chair of the Medical Pharmacology Department) and Dr. Anders Bill (Chair of the Medical Physiology Department), both Friedenwald awardees. Dr. Kaufman thus emulated Friedenwald, who sought training with the best teachers of his era in Dr. Fredrick Verhoff and Dr. George de Schweinitz. Dr. Kaufman thus began a career that has transformed our understanding of aqueous humor outflow and the biomechanics of accommodation and its age-related decline. In each of these areas Paul has established rigorous and reproducible laboratory models that not only have facilitated development of the most important present and future drugs for treating glaucoma (the most common cause of irreversible visual loss worldwide) and of therapeutic approaches to the treatment of presbyopia (the most common and irrevocable ocular affliction worldwide), but also have become standard research tools for investigators in these areas worldwide.

Dr. Kaufman's contributions demonstrate an exceptionally keen insight into the science of vision. These include developing and refining unique and innovative surgical techniques as well as gold standard measurement techniques for determining IOP and conventional and uveoscleral outflow

in monkeys to thoroughly test all iterations of aqueous humor dynamic hypotheses. His unerring focus on the clinical relevance of his laboratory research has resulted in seminal translational observations in monkeys and humans that led directly to the introduction of the prostaglandin agonists for glaucoma in 1996 (latanoprost [Xalatan] was the first "billion dollar compound" in ophthalmology) to development of novel classes of therapeutic compounds for enhancing conventional outflow facility based on agents that affect cytoskeletal-mediated contractility and cell adhesion in the trabecular meshwork. One has already been approved in Japan.

In the field of accommodation, Paul has systematically and painstakingly examined the roles of the lens, the ciliary muscle (including neurotransmission and neurochemistry), the choroid, and the zonules to elucidate the contribution of each in the age-related loss of accommodation that only a short time ago was taught to residents and medical students as being strictly a limitation of lens elasticity. Thanks to Dr. Kaufman's rigorous studies, such a simplistic hypothesis is no longer the standard teaching, and the design of accommodating intraocular lenses is being reconsidered based on these findings.

What allowed Paul to make these seminal lifetime contributions in two related but distinct areas was inexorably linked to his extraordinary training with exceptional mentors who provided formal training in the essential but different disciplines required for drug and device development (e.g., pharmacology, physiology, cell biology, anatomy, biomechanics). But there was something more, which I suggest is Paul's remarkable insight, vision, skills, and abilities that allowed him to combine seemingly disparate pieces of information, from multiple collaborators and fields, into clinically relevant advances. This is, in many ways, Paul's essential gift. Dr. Kaufman is nearly unique in the breadth and depth of his scientific and clinical understanding as it pertains to the science of both glaucoma and accommodation. In combining singular skills and a unique vision, he has made multiple seminal contributions in multiple subfields of ophthalmic research. Paul's numerous contributions, detailed below, have provided translational relevance and clinical impact that is both extraordinary and important.

His service contributions to our field are no less noteworthy. He has received over 40 years of National Institutes of Health funding resulting in over 350 articles and 75 book chapters and is coeditor of *Adler's Physiology of the Eye*. He served as the Chairman of the Department of Ophthalmology at the University of Wisconsin from 2004 to 2014 and was the president of the International Society for Eye Research from 2003 to 2014 and ARVO from 1997 to 1998. In addition, he has served on the Board of Trustees at ARVO and the Board of Governors of the ARVO Foundation for Eye Research. He is in constant demand as an invited speaker at international meetings and academic institutions and a much sought-after consultant to corporations specializing in pharmaceuticals,

intraocular lenses, and surgical instrumentation in the ophthalmic space.

Paul's humility, collegiality, and respect for those below him, above him, before him, and after him are some of the many extraordinary qualities that make him truly exceptional. To have been trained by Paul Kaufman is a privilege that unfortunately I did not enjoy. However, to have benefited from his many talents as a colleague makes me indeed honored to introduce this most worthy recipient of the 2017 Jonas S. Friedenwald Award.

### ***Essential References***

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