Optical Engineering in Ophthalmology

Suganda Jutamulia, MEMBER SPIE
Kowa Company, Ltd.
Silicon Valley Office
100 Century Center Court, Suite 302
San Jose, California 95112

Toshimitsu Asakura, FELLOW SPIE
Hokkaido University
Research Institute for Electronic Science
Sapporo, Hakkido 060
Japan

No doubt, ophthalmology is one of the oldest sciences of optics. The function and structure of the eye have been attracting much attention and fascinating philosophers, physicists, and physicians for centuries. Yet, in contrast to the fundamental study of the eye, this special section is devoted to the applications of modern optical engineering to the diagnosis and therapeutics/surgery of the eye. Ophthalmic equipment is continually improving as a result of collaboration and interaction between optical researchers and clinical investigators applying state-of-the-art optical techniques that involve lasers and other recent inventions. The eye is not only the window of the soul; rather, the eye is indeed the window of the body to the outside world. In other words, light can enter the body only through the eye. Therefore, light can be utilized to check and to treat the eye inside the body. We hope that this special section will inspire more applications of optical science and engineering to medical technology and health care.

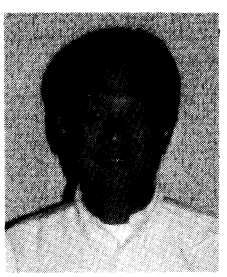
The eye can be divided into three parts: cornea, lens, and retina. This special section begins with the cornea. The papers of Ren et al., Pettit et al., and Lin review the state of the art of corneal shape forming using lasers. McLaren et al. present a video pupillometer. The papers of Masters and Ichihashi et al. discuss confocal imaging and polarization of the cornea, respectively.

The papers of Drexler et al. and Schmetterer et al. discuss the measurement of fundus layers and pulsations, respectively. The retinal scanning imaging technique and indocyanine green (ICG) fluorescence angiography are reviewed in the papers of Kobayashi and Asakura, and Flower, respectively. Klingbeil et al. describe a laser fundus camera for infrared angiography. The measurement of blood flow using Doppler and speckle techniques is described in the papers of Riva and Petrig, and Konishi and Fujii, respectively.

Photography of the lens and the anterior eye segment is reviewed in the paper by Sasaki. Enoch et al. describe a technique to test a cataractous lens. The image quality of intraocular lenses is discussed in the paper by Artal et al. Fourier transform by the lens is proposed by Jutamulia and Gheen.

The paper of Wihardjo concerning the measurement of the astigmatism of ophthalmic lenses concludes this special section.

We would like to thank the authors who accepted our invitation to contribute to this special section. We also would like to express our appreciation to the many reviewers who took the time to read and to provide critical comments on the papers. Dr. Jutamulia acknowledges Mr. Yoshihiro Miwa, vice president, Dr. Hideo Tani, director of the Kowa Research Institute, and Mr. Hiraki Okada, manager of business development, all of Kowa Company, Ltd., for allowing him to work on this special section. Last, but not least, we are most grateful to Professor Brian J. Thompson who gave us the opportunity to organize this special section.



Suganda Jutamulia received the PhD degree in electronic engineering from Hokkaido University, Japan, in 1985 under Professor Toshimitsu Asakura's guidance. He completed his BS degree in physics at the Institute of Technology, Bandung, in 1977 and his MS degree in optoelectronics at the University of Indonesia in 1979. He was a research associate and an instructor in the Electrical Engineering Department at Pennsylvania State University from April 1985 to June 1988. He was then a senior scientist with the Quantex Corporation, Maryland, from June 1988 to March 1991. He is currently the general manager of research and development at Kowa Company Ltd., Silicon Valley Office, San Jose. His research interests include medical optics, optical signal processing, optical computing, neural networks, and all aspects of optical engineering. He has more than 90 publications and presentations to his credit. He has been granted five U.S. patents. He is the coauthor of *Optical Signal Processing, Computing, and Neural Networks,* published by Wiley (1992). He is the editor of *Selected Papers on Optical Correlators* (1993) and *Selected Papers on Optical Neural Networks* (1994), published by SPIE. He is now coediting *Optical Memory and Neural Networks* for Marcel Dekker and *Optical Pattern Recognition* for Cambridge University Press. He is a guest editor of a special issue on technologies for optical memory in *Optical Memory and Neural Networks* (1995) and on optical information processing in *Proceedings of the IEEE* (1996). He is on the editorial board of *Optical Memory and Neural Networks* and is a reviewer of various scientific journals. He is also a part-time associate professor of biomedical engineering at the University of Northern California and a member of SPIE, OSA, IEEE, and the Japan Society of Applied Physics.

Toshimitsu Asakura received his MA in 1960 from Boston University and his DEng in 1965 from the University of Tokyo. He was a research assistant at the Physical Research Laboratories, Boston University, from 1957 to 1958 and a member of the research staff at the Research Laboratory of Itek Corporation from 1958 to 1961. After five years as a research associate at the Research Institute of Industrial Sciences, University of Tokyo, he became an associate professor in the Department of Applied Physics, Hokkaido University, Sapporo, Japan, in 1966. In 1971 he was promoted to professor at the Research Institute of Applied Electricity (now the Research Institute for Electronic Science), Hokkaido University, the position he now holds. Since April 1994, he has also been director of the above institute. His areas of research have been in optics and related fields, particularly in relation to the properties and applications of laser light. He has published more than 600 papers in technical journals and other publications. Prof. Asakura is now vice president of both the International Commission for Optics and the Asian Pacific Optics Federation, president of the Optical Society of Japan, a fellow of OSA and SPIE, and a member of numerous technical societies in Japan. He received the Best Optics Paper Award from the Japan Society of Applied Physics in 1962, the Hokkaido Science and Technology Award in 1986, the award from the Japan Society of Applied Physics in 1993, and the Shimazu Prize from the Shimazu Science and Technology Promotion Foundation. He is a member of the advisory editorial boards of various international journals and the book *Progress in Optics*.