

# Preface

In the past, major causes of blindness were infection and cataracts. At the time, these conditions were thought to be incurable and inflicted debilitating effects on the quality of life. However, advances in pharmacology and surgery have changed this situation remarkably, and these conditions are now treatable and preventable. Instead of infection and cataracts, the majority of causes of blindness in developed countries in the last few decades have become retinal or optic nerve degeneration. These are the current challenges we must face, and development of strategies for protection of retinal cells and the optic nerve with drugs is urgently required. Currently, many preclinical reports on neuroprotection are available, and they have revealed a number of potential therapeutic targets although they have not yet supplied sufficient data for use in clinical settings. However, while there has been a significant increase in understanding of novel or detailed cell death mechanisms, which is useful for identifying novel targets, research into gene therapy using several neurotrophic factors for protection of retinal cells is progressing. These developments are providing hope for patients whose sight is affected by retinal degeneration.

Most recently, work by the Nobel Prize winner Shinya Yamanaka has attracted much attention and inspired many researchers in the medical field. It has encouraged regenerative therapy by cell transplantation with induced pluripotent stem (iPS) cells, and this technology will benefit many people suffering from diseases that require replacement of affected cells and tissues. Application of this strategy in the ophthalmic field has a promising future, and indeed, safety trials for the use of iPS cells in patients with age-related macular degeneration (AMD) will be starting soon. Stimulation of neuroprotection and neuroregeneration will provide effective treatment for retinal and optic nerve degeneration, and one day these conditions will be curable as cataracts now are. To this end, research into retinal neuroprotection and neuroregeneration has provided some convincing results so far and this field is advancing rapidly. Therefore, it is essential for clinicians and researchers

of ophthalmology to keep up-to-date with the latest information from preclinical and clinical studies, although it is not very easy to do so. The aim of this book is to summarize the recent progress in neuroprotection and neuroregeneration of the retina and optic nerve in both preclinical and clinical aspects of ophthalmology.

It has been estimated that glaucoma will affect more than 80 million individuals worldwide by 2020, with at least 6–8 million people becoming bilaterally blind. Glaucoma is a leading global cause of irreversible blindness and is perhaps the most prevalent of all neurodegenerative diseases. Thus, we devote a large section to glaucoma (Part I, Chaps. 1–13). There are many aspects of this disease and potential therapeutic targets. Part I of the book describes the pathological mechanisms and retinal ganglion cell death, including glutamate neurotoxicity, calcium signaling, and oxidative stress. It also provides information on the roles of glial cells and microglial cells, a new form of necrosis, and axonal flow disturbance and degeneration, together with possible therapeutic strategies for glaucoma.

On the other hand, AMD is the biggest cause of blindness in the United States and European countries. Epidemiological studies have revealed that AMD has many aggravating factors including smoking, light toxicity, and oxidative stress, and it is known that intake of vitamins and lutein, which are antioxidants, shows preventive effects against this condition. Moreover, wet-type macular degeneration, which is associated with neovascularization, is commonly treated with intraocular injection of drugs targeting vascular endothelial growth factor (VEGF). Major advances in treatment strategies are being achieved in this field. In some types of AMD and retinitis pigmentosa, the retinal pigment epithelium (RPE) is disturbed, and thus investigations from cell-biological aspects, such as studies on protection of photoreceptors and RPE and interaction between photoreceptors–RPE, are discussed in Part II (Chaps. 14–18).

Furthermore, mechanisms underlying retinal detachment, uveitis, and optic neuritis, as well as neuroprotection in each disease, are discussed in Part III (Chaps. 19–23). Like glaucoma and AMD, these conditions affect many people and cause debilitating effects on the quality of life. In addition to neuroprotection, use of candidates other than iPS cells, such as endothelial progenitor cells (EPC), for retinal regeneration and optic nerve regeneration research provides good prospects for the future. For example, novel strategies exploiting neuroinflammation and stimulating cytoskeletal organization in growth cones are noteworthy.

This book was mainly written by up-and-coming ophthalmologists who are specialized in retinal diseases and are devoted to both clinical and preclinical research. However, each chapter is written in such a way that beginners in the field can understand the complex contexts. We believe that the contents of this book will appeal to a wide variety of readers with an interest in ophthalmic research and will be particularly useful to ophthalmologists in training and also to medical students and scientists who are outside the field. Some readers may wish to skip certain specialized areas at first, but that is not a problem. It is more important for one to enjoy reading the parts that are of interest or that are one's favorite topic.

On the other hand, we hope that those who are busy ophthalmic specialists can acquire the latest preclinical and clinical knowledge in a short time from *Neuroprotection and Neuroregeneration for Retinal Diseases*.

Sendai, Miyagi, Japan  
Kawasaki, Japan  
Tokyo, Japan

Toru Nakazawa  
Yasushi Kitaoka  
Takayuki Harada

**Neuroprotection and Neuroregeneration for Retinal  
Diseases**

Nakazawa, T.; Kitaoka, Y.; Harada, T. (Eds.)

2014, X, 356 p. 85 illus., 61 illus. in color., Hardcover

ISBN: 978-4-431-54964-2