

Establishing research in ophthalmology and visual sciences at the University of Hong Kong: an institution profile

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Abstract

Established in 2006, the Department of Ophthalmology of the Li Ka Shing Faculty of Medicine, University of Hong Kong became the territory's second clinical academic unit in ophthalmology and visual science. Under the leadership of Professor David Sai Hung Wong (recently succeeded by Professor Jimmy Shiu Ming Lai), the department has focused on clinical excellence and research in vitreoretinal disease, glaucomatous optic neuropathy, and cornea and external eye disease. Through collaboration with leading ophthalmic institutions locally and abroad, the department aims to become one of the top academic institutions in Southeast Asia.

Key words: Anterior eye segment; Glaucoma; Retina

Introduction

The Department of Ophthalmology was established in 2006 as the Eye Institute of the Li Ka Shing Faculty of Medicine, University of Hong Kong and subsequently recognized as an independent department in 2013. It became the territory's second clinical academic unit in ophthalmology and third visual science research centre. Professor David Wong, a renowned vitreo-retinal surgeon and clinician-scientist from the United Kingdom, was selected as the founding Chair Professor and head. Professor Wong was consultant

ophthalmologist at the Royal Liverpool Hospital and chairman of the Scientific Committee of the Royal College of Ophthalmologists as well as its Senior Vice President. In 2005 he was made an honorary Professor of the University of Liverpool in recognition of his outstanding contribution to ophthalmic research. He was also the founding member of the British Association of Vitreoretinal Surgeons and board member of the European Society of Retinal Specialists. Professor Wong's appointment at the University of Hong Kong would not have been possible without Mrs Felicia Young and family's very generous contribution through the Albert Bing Ching Young Endowed Chair Professor in Ophthalmology.

In 2007, a team comprising Professor Wong, Dr. Wico Wai Kwan Lai and Dr. Kenneth Kai Wang Li was formed at the Department of Ophthalmology of the Queen Mary Hospital to initiate translational research in visual sciences. Dr. Amy Cheuk Yin Lo, a neuroscientist from the university's Department of Anatomy, was recruited to head the department's research postgraduate studies and laboratory research. Not long afterwards, the department added Professor Jimmy Shiu Ming Lai and Dr. Carol Shan Yu to the ranks, thereby broadening the scope of research specialties.

Over the last 10 years, an aging population in Hong Kong has increased the burden on public specialist ophthalmic services, and there is an increasing demand by patients for advanced technological solutions and increased opportunities to expand our work into Mainland China. In 2012, the HKU-Shenzhen Hospital in Shenzhen, China was opened, with our department providing training and clinical services in

ophthalmology. To meet the demands of a broader scope of service, a number of young clinician-scientists were recruited, including Dr. Raymond Lai Man Wong, Dr Marcus Marcet, Dr Jacky Lee, Dr. Ian Yat Hin Wong, Dr. Kendrick Co Shih, Dr. Bonnie Nga Kwan Choy, Dr. Alex Lap Ki Ng and Dr. Jennifer Wai Huen Shum. The laboratory team was expanded with the addition of Dr. Bin Lin, Dr. Qizhou Lian and Dr. Catherine Chiu as principal investigators.

This paper reviews their significant contributions over the years.

Vitreoretinal disease

Led by Professor Wong, much of the department's initial research focused on 3 main areas of vitreoretinal disease: surgical retina, diabetic retinopathy screening and retinal neuroprotection.

In 2009, we established Hong Kong's first territory-wide centralised diabetic retinopathy screening program in the Hospital Authority. Through the use of telemedicine technology, we were able to provide cost-effective screening and arbitration services for public primary care facilities all over Hong Kong. The introduction of the screening program also resulted in a number of published collaborative epidemiological studies on the subject.^{1,2} Another major research area was surgical retina,^{3,4} especially with regard to the use of silicone oil and the emulsification process, a troublesome and potentially devastating long-term complication.⁵⁻⁷ Working with university's mechanical engineering department, our team further developed *in-vitro* models (Eye-on-a-Chip) to further study the emulsification process in different conditions using silicone oils of different molecular weights.⁸⁻¹⁰ Last but not least was our department's significant contribution to retinal neuroprotection research. This area was laboratory-based with the use of both animal experimental models and *in-vitro* models using cell culture. The neuroprotective agents studied during this period included supplements like lutein¹¹⁻¹⁵ and lycium barbarum^{16,17} as well as stem cell therapy techniques.¹⁸ Our group also investigated the effect of aldose reductase deficiency on ameliorating retinal ischemia-reperfusion injury in animal models.¹⁹⁻²¹

With the addition of more academic staff with special interests in the field of vitreoretinal diseases, the scope of research interests was extended to medically treated retinal diseases and posterior segment imaging, while continuing in the established themes such as surgically treated retinal diseases.^{22,23} For instance, the utilization of optical coherence tomography, in particular enhanced-depth-imaging to measure choroidal thicknesses, and its relation to important pathologies.²⁴⁻²⁸ Participation in international multicenter clinical trials by the clinical trials team for retinal diseases of the University of Hong Kong was another major leap forward. With Dr. Ian Wong as the principal investigator, the team has participated in numerous trials and studies, including the VIVID EAST, EVEREST 2, PLANET,

CEDAR and UNCOVER, to name a few.

Another focus in recent years was the development of new treatment regimens for medically treated retinal diseases such as diabetic macula edema, central serous choroidoretinopathy, polypoidal choroidal vasculopathy and retinal vein occlusive disease.²⁹⁻³⁷ The vitreoretinal service also involved in the management of infectious uveitis, especially cytomegalovirus retinitis among immunocompromised patients. The affiliated teaching hospital — Queen Mary Hospital — is a designated transplant center for bone marrow, liver, lungs and kidneys. Close collaboration between our staff and other medical colleagues has enabled the development of expert care and research in this field.³⁸⁻⁴⁰

Glaucomatous optic neuropathy

With the arrival of Professor Jimmy Shiu Ming Lai in 2009, our department was blessed with one of the region's renowned experts in glaucomatous optic neuropathy. Already a well-published author in the field, Professor Lai led a young team to develop new areas of research, including epidemiology, therapeutic lasers, minimally invasive glaucoma surgery and most recently the use of cross-linking techniques in glaucoma. He also collaborated with a number of laboratory-based researchers to develop neuroprotection in glaucoma.

Much of the epidemiological research conducted at the department was based on estimating prevalence, disease burden and risk factors of glaucomatous optic neuropathy. This was led by a number of ongoing collaborators, chiefly Dr. Jacky Wai Yip Lee, who is now in private practice. Our research group utilized new technologies, including optical coherence tomography and 24-hour intraocular pressure (IOP) monitoring, to conduct a number of epidemiological studies.⁴¹⁻⁵⁰ Professor Lai's team has also been actively involved in the refinement of primary angle closure glaucoma management. This is especially important in the context of Southeast Asia, where this subtype represents up to 80% of all glaucoma cases.⁵¹⁻⁵⁴ Amongst these publications, the most important contribution was the team's involvement in the multi-national, multi-centre randomized controlled trial comparing early lens extraction for angle closure glaucoma and conventional therapy.⁵⁵ Another area of research that was initiated by Professor Lai and greatly expanded after his arrival at the department was the use of selective laser trabeculoplasty for glaucoma. The technique utilizes a frequency-doubled N: YAG laser and minimizes permanent damage to the trabecular meshwork, compared with conventional argon laser trabeculoplasty techniques. This allows the procedure to be repeated. While the initial research work was on its effectiveness in primary open angle glaucoma, Professor Lai's team successfully demonstrated its effectiveness in normal tension glaucoma as well, with a reduction in IOP fluctuation over 24-hours.^{43,52,56-65} The university's glaucoma team also utilized minimally invasive surgical techniques, including trabectome and eXPRESS

shunt implantation, to expand available treatment options for lowering IOP in glaucoma patients.^{66,67} Ultimately as IOP lowering therapy remains the only proven treatment in the context of glaucomatous optic neuropathy, Professor Lai's team has also worked towards introducing IOP-independent neuroprotective strategies to glaucoma. His laboratory team is currently investigating the effectiveness of trans-corneal electrical stimulation to improve retinal ganglion cell survival using both acute and chronic ocular hypertensive injury models in animals.^{68,69}

Most recently Professor Lai's team came up with new ways to utilize cross-linking technology. This was a method to rapidly and safely strengthen covalent bonds within tissue and was first used for cornea ectatic disease. It is currently approved by the US Food and Drug Administration for the treatment of keratoconus. Professor Lai's team successfully used this technique to treat leaking blebs after glaucoma surgery. With a single treatment using the conventional protocol, bleb leakage was halted in a preliminary study of 5 eyes.⁷⁰

Cornea and external eye disease

Our department's newest area of research is that of cornea and external eye diseases. While still in the early stages, the focus is on cornea cross-linking therapy and regenerative therapy. We have also initiated epidemiological work in microbial keratitis^{71,72} and in the prevention of myopia progression with topical atropine.⁷³ Our department recently began conducting research into corneal cross-linking. The research work is led by Dr. Alex Lap-Ki Ng, in collaboration with colleagues from the Department of Ophthalmology

and Visual Sciences at the Chinese University of Hong Kong, Hong Kong Sanatorium and Hospital as well as Hong Kong Laser Eye Centre.⁷⁴⁻⁷⁶ Dr. Ng's group concentrated on the different protocols of cross-linking, and extending its application to laser refractive procedures including LASIK and ReLEx small-incision lenticule extraction. The aim is to reduce ectatic complications and myopia regression after laser vision correction.

One of the most topical areas in corneal research is currently wound healing and regenerative therapy. Our laboratory team, led by Professor Wong and Dr. Qizhou Lian, have developed techniques to promote corneal epithelial wound healing after chemical injury.⁷⁷ Furthermore, they have identified and characterized progenitor cells in the cornea endothelium and trabecular meshwork that may serve as a source of replenishment for an aging cornea.^{78,79} Most recently, Dr. Catherine Chiu's team has been working to characterize lens epithelial proliferation and migration after injury in order to understand its potential in wound healing.⁸⁰

Future plans

Looking forward to the next 10 years, our department's focus is on the understanding and treatment of eye diseases relevant to patients in Asia. We aim to consolidate our current strengths and develop new research areas, all the while fueling it with the enthusiasm of a youthful team. We remain greatly in debt to the established clinical and academic institutions in Hong Kong for their support throughout our department's infancy. To secure Hong Kong's future as a leading epicentre for ophthalmic research, the way forward is through collaboration.

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