1 Expansion of Asian Eye Genetics Consortium (AEGC) to Global Eye Genetics Consortium (GEGC), Introduction of a Global Phenotype-Genotype Database "GenEye" and Launch of New Training Programs at National Eye Institute (NEI)

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Abstract

The Asian Eye Genetics Consortium (AGEC) established in 2014 brought collective thinking and ideas of the Asian and non-Asian researchers who have an interest in genetic eye research. As the consortium grew, requests to join the consortium from outside of Asia were increasing. During the AGEC meeting at ARVO 2018 in Honolulu, USA, the members unanimously voted to expand the consortium activities beyond Asia and explore unique phenotype and genotype populations in the rest of the world, particularly in Africa and South America. The consortium was renamed the Global Eye Genetics Consortium (GEGC, https://gegc.org) by the general membership. The consortium aims were adjusted and the new GEGC phenotype-genotype database GenEye (https://geneye.kankakuki.jp) was constructed to collect and catalog genetic eye diseases at global scale. GEGC membership has grown to over 200 from five continents, performing GEGC meetings and sessions during ARVO, AIOS, APAO, WOC, and ISER meetings. A number of scientific collaboration and young investigator visiting programs have been successfully launched over the past 6 years.

Keywords

Eye · Genetics · Database · Asia · Africa South America · Global

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G. Prakash, T. Iwata (eds.), *Advances in Vision Research, Volume III*, Essentials in Ophthalmology,
https://doi.org/10.1007/978-981-15-9184-6_1

1.1 Expansion of the Consortium from Asia to Global: Launch of the Global Eye Genetics Consortium (GEGC)

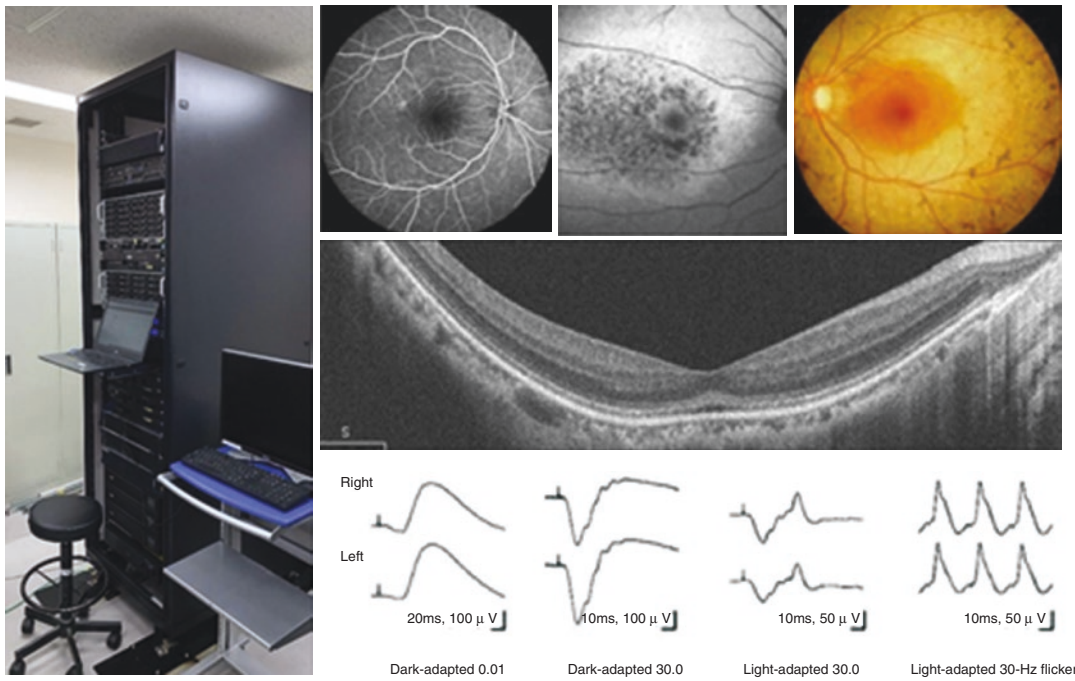
The annual meeting of AEGC was held on May 2, 2018, during the ARVO meeting at Hawaii Convention Center, Honolulu. The status of AEGC database construction was given by Dr. Takeshi Iwata from the National Institute of Sensory Organs (NISO), Japan, followed by an introduction of the European Retinal Disease Consortium by Dr. Frans Cremers and Dr. Susanne Roosing from the Department of Human Genetics, Radbound University Medical Center, Netherlands. Dr. Gyan Prakash from the National Eye Institute (NEI), USA reported the successful publication of Springer Nature, Advances in Vision Research, Volume II, and inviting ideas for Volume III.

Dr. Iwata and Dr. Prakash explained the increase of interest to join AEGC from researchers in Africa, South America, and other parts of the world, and proposed the consortium operation to go global. By a unanimous vote, the global operation was approved, and the consortium name was changed to the GEGC under the same governance structure.

Dr. S. Natarajan from Aditya Jyot Eye Hospital from India gave a status report on the establishment of a new eye genetics research unit in Mumbai followed by another status report from Dr. Kaoru Fujinami from NISO about the East Asia Inherited Retinal Diseases Studies. Mrs. Pamela Sieving from NEI gave a talk on the activity of genetic eye studies in Asia using the bibliometric analysis and showed how this analysis can be used at global scale. The final two talks were about clinical trials in the UK and China. Dr. Rupert Strauss, MD, Moorefields Eye Hospital, University College of London, UK gave a talk on the "ProgStar: International study of Stargardt Disease," explaining the challenges to standardize and unite the group. Dr. Zheng Qin Yin from Southwest Eye Hospital/Southwest Hospital, Third Military Medical University, China discussed development in gene therapy of the eye diseases in China.

1.2 Launch of GEGC Phenotype-Genotype Database "GenEye"

From the early stage of AEGC, the phenotype-genotype database was considered essential for its operation. In 2019, a new phenotype-genotype database, GenEye (https://geneye.kankakuki.jp) was developed at NISO. The database currently contains three diseases including inherited retinal diseases (IRD), age-related macular degeneration (AMD), and glaucoma. The international standard Human Phenotype Ontology (HPO) term is used throughout the database to describe the patient phenotype. Authentication is required for the user to restrict data viewing only to the collaborators before publication.



To facilitate the best design of the GEGC database, a series of meetings were held with experts from around the world in the last 3 years to garner experience from different data platforms. These included meetings with Dr. Takeshi Iwata from NISO, providing an example of the Japanese IRD database, meeting with Dr. Andrew Webster from Moorefields Eye Hospital about the UK IRD database, and meetings with Dr. Kerry Goetz and Dr. Santa Tumminia from NEI about the US eyeGENE database.

GEGC is currently promoting research groups with no access to the phenotype-genotype database to collect and store patient data into GenEye. The first phase of GenEye is to accumulate phenotype data from Asia, Africa, and South America into GenEye and later plan for whole genome analysis by international collaboration and funding. Asia, Africa, and South America are under-represented in the global knowledge base, however these regions are some of the most populated and information gained from these regions will greatly advance our understanding of molecular mechanisms and pathobiology of genetic eye diseases. The outcomes of the GenEye are expected to catalog genome mutations and variants associated with specific genetic eye disease across Asia, Africa, and South America. It will also provide big data sets at global scale for artificial intelligence (AI) and machine learning to develop future diagnostic systems without the presence of an ophthalmologist. GEGC is also expected to work with drug companies planning for clinical trials at a global scale. GenEye will quickly identify patients with the same disease and genome mutation for each location, benefiting the companies via a shorter time period to decide where to set up the center for maximum patient recruitment.

1.3 The Updated Aim, Management, and Budget for GEGC

1. Share genetic information to isolate common genetic variants associated with eye diseases
2. Establish cost-effective genetic analysis and accurate diagnosis for grouping of genetic eye diseases
3. Develop research-oriented database to collect and catalog genetic eye diseases at global scale
4. Support and foster global collaboration and scientific exchanges for the advancement of genetic eye research
5. Collaborate with other international and regional organizations with similar goals
6. Organize regional congresses and other educational and scientific activities to promote goals of the consortium

The aim of GEGC was re-adjusted to fulfill the need for the global operation. Recruitment of members to the establishment of Scientific Committee, Clinical Diagnostic Committee, Ethics Committee, and additional Vice Presidents from Africa and South America, are being discussed. At the GEGC executive meeting at APAO in Bangkok, Thailand on March 7, 2019, Dr. Calvin Pang from the Chinese University of Hong Kong, China was appointed as Chief of GEGC Scientific Committee. These committees will play an important role to keep GEGC operation at global standard.

Self-sustainable budget is an important aspect of collaboration in GEGC. Most research grants in the countries limit DNA sequencing to local patients and do not allow any import or export of genetic materials for patients from abroad. An international collaboration grant is jointly planned for submission to the Japan Society for the Promotion of Science (JSPS) and Department of Science and Technology (DST) of India. Additional scientific grant submissions are planned for NIH (USA).

A multifaceted global effort like GEGC has the potential to accelerate the collaborative genetic eye research in generating useful new scientific data to help our understanding of genetics in eye diseases. The GEGC is seeking to uncover new scientific opportunities and identify shared priorities to create unique international collaborations in genetic eye research. The GEGC has created a wide opportunity to establish partnerships among scientists, governments, companies, and non-government organizations to support research programs for understanding the biology of eye diseases on a global level.

1.4 GEGC Lab Exchange Program for Young Scientists

During the last 7 years, eight researchers have used the Lab Exchange Program of AEGC/GEGC to visit foreign labs to experience how the genetic research is operated. This program provides the opportunity for young scientists and strengthen future collaborations on genetic eye research around the globe. The hands-on training for the GEGC members are one of the key goals of this Lab Exchange Program. Such programs have helped establishment of the new GEGC eye genetic laboratories in Mumbai, India. GEGC is working on government funding or corporate support to conduct whole genome sequence on DNA samples from the countries that have limited or no research funding locally. Over 200 eye researchers from more than 30 countries have become GEGC members since its inception. The members are currently interacting and collaborating to develop research programs to catalog and share disease-causing gene mutations of genetic eye diseases in Asia, Pacific, Africa, and South America.

1.5 GEGC as a Member of the International Council of Ophthalmology (ICO)

The first GEGC annual meeting was held on April 29, 2019, during the ARVO meeting in Vancouver, Canada. Representative from 18 countries gathered to this meeting. After the introduction of GEGC, President of International Council of Ophthalmology (ICO), Dr. Peter Wiedemann and Vice-President, Dr. Neeru Gupta welcomed GEGC as a new member of the ICO. GEGC will now work with ICO to expand in Africa and South America. Mrs. Sieving gave a talk about the scientific activities in Africa and South America based on the bibliometric analysis in these regions.

Dr. Margaret DeAngelis, a member of the International AMD Consortium, University of Utah, USA gave a talk on how to organize international consortium, showing pitfalls that she experienced and how the consortium dealt with the difficulty. The ongoing construction of the new GEGC phenotype-genotype database "GenEye" was introduced by Dr. Iwata. To meet the next level of research at a global scale, establishment of Scientific Committee, Clinical Diagnostic Committee and Ethics Committee were discussed with the team consisting of Dr. Iwata, Dr. Prakash, Dr. Baird, Dr. Natarajan, Dr. Pang, Dr. Tumminia, and Dr. Goetz.

1.6 New International Training Programs/Fellowships in Genetic Eye Research at National Institutes of Health: National Eye Institute in the USA

1.6.1 New Program Launch: NEI-ICO Fellowship for International Fellows from Lower- and Middle-Income Countries (LMIC)

NEI has just started a new ICO Fellowship being managed by the International Council of Ophthalmology (ICO). The new program was kicked off at ARVO-Vancouver, Canada in May 2019. The fellowship is directed for early-career meritorious *candidates/clinicians from* LMICs to have one fellowship per year generally for one-year duration at NEI in Bethesda, Maryland, the USA beginning in 2020.

1.6.2 Expansion of International Genomics Fellowship at National Eye Institute in the USA

NEI is working in collaboration with National Human Genome Research Institute (NHGRI) at NIH to organize the month-long fellowship for early-career lab/research and clinical scientists from the lower- and middle-income countries. The fellowship started 5 years back and is likely to continue based on the funding. In 2019, NEI became the largest sponsor of international fellows (total 5 in 2019) at the NIH wide International Genomics Summit. Over the past 5 years and from the beginning of this program, NEI-NIH has sponsored and trained ten international fellows since the launch of GEGC. The early-career scientists have come from several other countries, including India, Ukraine, Turkey, Pakistan, Bangladesh, Nigeria, Argentina, and Mexico.

1.7 Updates on Other GEGC Sessions and Meetings During 2018 to 2019

1.7.1 GEGC Session at SAARC Academy of Ophthalmology 2018

The GEGC session was held during the South Asian Association for Regional Cooperation (SAARC) Academy of Ophthalmology (SAO) meeting on June 22, 2018, at Hotel Yak and Yeti, Kathmandu, Nepal. Over 80 people attended the meeting.

After the SAO meeting, Dr. Takeshi Iwata and Dr. Paul Baird visited the B. P. Eye Foundation and the Tilganga Institute of Ophthalmology in Kathmandu.

1.7.2 GEGC Meeting at World Ophthalmology Congress 2018

The GEGC meeting was held during the World Ophthalmology Congress on June 18, 2018, at Barcelona Convention Center in Barcelona, Spain. Introductory comments were made by Dr. Hugh Taylor and Dr. Peter Wiedemann, the President and incoming President of ICO, respectively. Dr. Gyan Prakash from NEI, USA, and Dr. Paul Baird from the University of Melbourne, Australia gave the introduction of GEGC and the update on the Springer Nature Advances in Vision Research Volume II. Dr. Calvin Pang from the Chinese University of Hong Kong gave an overview of the research in retinal diseases of China followed by Dr. Paisan Ruamviboonsuk, applying AI for screening diabetic retinopathy in Thailand. The last talk was given by Mrs. Pamela Sieving about the bibliometric analysis of the AEGC research. Dr. S. Natarajan from Aditya Jyot Foundation for Twinkling Little Eyes, India did the closing remarks.

1.7.3 Foundation of the GEGC China Branch

On June 28, 2018, at Kempinski Hotel Chongqing, China, a meeting for the foundation of the GEGC China Branch was held by the leadership of Dr. Zheng Qin Yin from Southwest Eye Hospital/ Southwest Hospital, Third Military Medical University, China and Dr. Qingjiong Zhang from Zhongshan Ophthalmic Center, Sun Yat-sen University, China.

1.7.4 GEGC Session at Asia Pacific Academy of Ophthalmology 2019

The GEGC Symposium was held on March 6, 2019, during the Asia Pacific Academy of Ophthalmology at Bangkok Convention Center in Thailand. The following talks were given by the speakers. Novel Genes Identified for Inherited Retinal Diseases in Asian Population by Takeshi Iwata, From Genome-wide Association Studies to Mendelian Randomization: Opportunities for Understanding Ocular Disease Causality by Dr. Ching-Yu Cheng, Can an Ophthalmologist diagnose a Rare Genetic Syndrome of Werner by Dr. Ahmed Reda, Leber's Congenital Amaurosis in China by Dr. Zheng Qin Yin, Role of GEGC, India Chapter in Promoting Eye Research by Dr. S. Natarajan, Successful Treatment of Secondary Choroidal Neovascularization Associated with Best Vitelliform Dystrophy with Anti-VEGF Therapy by Dr. Tharikarn Sujirakul, presentation by Dr. Amir Hossein Mahmoudi, and Research as a Tool for Serving Community Eye Health Needs and Building International Collaboration by Dr. Gyan Prakash.

GEGC continues to make special efforts in organizing and coordinating regional, national, and international conferences and symposia in order to bring research collaborators to expand the research and training activities. In the past 5 years, NEI in the USA has already trained a good number of next generations eye geneticists from lower- and middle-income countries. The trained scientists have returned to their home countries and organizations and have started setting up new labs and programs further enhancing various activities of GEGC. Additional new programs, symposia, and conferences have been planned in the US, India, Japan, South Africa, Argentina, China, and several other countries providing world-class opportunities at the regional level for the GEGC plans to grow and achieve its goals.