



## Research

*Last year, AMRF led two significant projects supported by government funding agencies: one focused on developing predictive biomarkers for glaucoma, and the other on creating interventional approaches to treat glaucoma using extracellular vesicles. These initiatives resulted in remarkable advancements across several fields. Further, AMRF hosted the AMRF-Dartmouth Education and Research Conference, paving the way for collaborative studies and knowledge sharing between the two institutions. Several new programmes with substantial funding were also initiated during the year, ultimately benefiting patient care, treatment, and cure.*

## Molecular Genetics

Ocular genetics lab has been working on advanced molecular techniques to uncover the genetic factors influencing ophthalmic conditions. Currently, the focus is on Leber's hereditary optic neuropathy (LHON), Leber's congenital amaurosis (LCA), and Primary Open-Angle Glaucoma (POAG).

LHON is a maternally inherited mitochondrial disorder caused by mitochondrial DNA (mtDNA) mutations. To study this, at AMRF, genetic testing was performed in 30 new patients, and found mitochondrial mutations in 21 patients. In the remaining cases, mutations were found in some nuclear genes, revealing the significance of mito-nuclear genetic involvement in LHON pathogenesis.

LCA is a severe form of inherited retinal dystrophy (IRD) and a leading cause of congenital blindness in children. With gene therapy emerging as a promising treatment, accurate identification of genetic changes have become even more important for providing the right medical care. At AMRF, whole-exome sequencing was performed on 51 patients, revealing mutations in 26 patients, with the highest mutation in the *CRBL* gene (n=5). Deep intronic and regulatory regions may be involved in negative cases, which could be identified by whole-genome sequencing.

POAG is a common eye disease that slowly damages the optic nerve and can cause permanent blindness. It happens due to a mix of reasons like high eye pressure, stress on eye cells, and inherited risks. At AMRF, research involved studying the trabecular meshwork (TM) – a part of the eye that controls pressure, and comparing both the mitochondrial DNA and the activity of genes in single cells from patients and healthy donors to understand why this tissue gets damaged in glaucoma. This research helped unlock the mysteries behind inherited eye diseases and brings us closer to personalised treatments and cures.

## Genetics of Ocular Tumours

Ocular tumours are often presented at late stages and hence their treatment remains as a challenge. Research in the department of Molecular genetics focused on a childhood tumour, retinoblastoma, and an adult-onset tumour, lymphoma. Development of reliable diagnostic and prognostic markers are essential to improve the overall treatment outcome of these tumours. A cost-effective genetic testing methods for retinoblastoma was developed and now implemented in routine clinical care.

During the last year, RBL genetic testing was carried out in 65 patients including 14 older patients who were visiting the clinic for follow-up and others were paediatric patients visiting the clinic for the first time. Mutations were identified in the blood samples of 21 patients. Absence of the mutations in the blood samples of other patients implied the low risk of RB in the future generation, as most of them were restricted to the tumour and not present in the constitutional cells.

Increased expression of a unique cell surface marker, GD2 synthase was found in RB patient samples with increased disease severity. Detection of this marker has better advantage of detecting minimal tumour spread, which is not possible with standard diagnostic tools, such as imaging techniques and cytology in cerebrospinal fluid. Hence GD2 synthase can be used as a potential marker for detecting the tumour spread.

Ocular Lymphoma is the most prevalent primary orbital malignancy in adults, with disease recurrence posing a major challenge in treatment. In the last year analysis of 19 patients, all of them except one were found to have unilateral disease and tumour lesions were localised in all the cases. Molecular analysis showed the alterations of immune functions, cell cycle and cell death pathways.

## Proteomics

### Fungal Keratitis

Extracellular vesicles of pathogenic fungi were not well understood. A comprehensive analysis of the extracellular vesicles produced by *Aspergillus flavus* and *Fusarium solani* were explored. These vesicles were characterised at the molecular level and the protein cargo was examined in detail. The saprophyte and clinical isolates differed in their EV composition also. The functions of these vesicles were being studied, and this allowed to examine the role of EVs in fungal infection. The role of EVs in host pathogen interaction was also examined using a cell culture model of fungal infection.

### Diabetic Retinopathy Project

Almost 17% of diabetic patients develop diabetic retinopathy (DR), a microvascular complication, and one of the earliest complications of diabetes. Among the DR patients, about four percent develop Sight Threatening Retinopathy (STDR). Further, among the undiagnosed prediabetic patients, the development of DR was much higher compared to the general



*Isolating RNA from corneal tissue*

population. In India, the incidence of DM varied anywhere from 12% to 27% of the general population among different states. Therefore, one of the unmet essential needs was prediction of those developing clinical DR before the onset of clinical symptoms among the DM patients. Previously, studies have shown Cystatin C, Leucine Rich Glycoprotein (LRG) and Complement factor B were the predictors of DR among DM patients.

Current study examines the proteins carried by the small extracellular vesicles (EV) for discovering biomarkers. EVs are lipid bilayer vesicles and carry defined cargo of proteins, DNA, RNA and lipids. The important point is their cargo reflect the physiological state of the producer cells. Therefore, they represent and carry the signature of the producer cells and are capable of delivering the cargo to cells. The move from one part of the body to other parts was facilitated through the circulation. They are the actual messengers of cells delivering the information across the body part. Using the isolated EVs from DM and DR patients, several markers were uncovered, including Cystatin C, Vitronectin, Serpin, Peroxiredoxin, Retinol Binding Protein 3 and other proteins. Interestingly, it was shown that RBP3 was not measurable in the plasma of patients, but the same could be measured in the plasma EVs. This important finding paved the way for developing a clinical assay to identify the biomarkers cost effectively from the plasma EVs.

### **Pterygium Project**

A study initiated to understand how changes in gene regulation, caused by epigenetic modifications like DNA methylation, contribute to the development of pterygium, a common eye condition caused by sun

exposure. In this study, tissues from people with pterygium to those from cataract patients were compared. They found that certain genes in pterygium tissue showed altered methylation patterns, some of which turned these genes “on” or “off” in ways that could lead to abnormal cell growth, inflammation, and tissue changes seen in pterygium. The researchers used cutting-edge tools like genome-wide methylation array to identify these changes, showing that specific genes involved in tissue remodelling and scarring were more active, while others tied to stress responses and DNA repair were less active. This is the first study of its kind to look at these kinds of gene changes on a global level in pterygium tissue, and it could lead to new ways of identifying new drugs for treating this common eye condition.

### **Keratoconus Project**

The project utilised previous findings to start a new investigation identifying specific genetic and protein markers responsible for the manifestation of keratoconus in Down syndrome (DS) patients. There was an increased incidence (10-300 times) of keratoconus (KC) in patients with DS. This investigation would help in early screening of the incidence of KC in DS patients thereby helping in the prevention of visual defects. Preliminary results obtained indicated high levels of tear MMP-9 in a few patients affected with DS. Correlation with the clinical data showed that the high tear MMP-9 level patients had low central corneal thickness and the corneal topographic images suggested that these patients were likely to develop KC disease. Further investigations were on to decipher the other molecules involved in the progression of KC among DS patients. This project was carried out in collaboration with Dr. V. Anitha, Chief, Cornea and Refractive Services, Aravind-Tirunelveli.

### **Ocular Pharmacology**

Glaucoma is the second leading cause of blindness worldwide. Glaucoma filtration surgery (GFS) remains the mainstay for the management of uncontrolled glaucoma. The surgical treatment of glaucoma lowers intraocular pressure (IOP) either by decreasing aqueous inflow or by increasing aqueous outflow. Trabeculectomy is the traditional incisional glaucoma filtration surgery in which aqueous outflow is enhanced either by augmenting the existing outflow pathways or by creating artificial outflow pathways into the sub-conjunctival or sub-tenon's space.

Trabeculectomy is the most common glaucoma surgery and is still in use even after the emergence of micro-invasive glaucoma surgical approach. The success of the trabeculectomy greatly depends upon the prevention of post-surgical scarring over the bleb with the use of antimetabolites, 5FU (5-fluorouracil) and MMC (mitomycin C). Despite of this, about 10% of the patients fail surgery leading to vision-threatening complications. With the use of MMC can cause some complications such as hypotony maculopathy and a leaky bleb that is susceptible to endophthalmitis results in surgical failure. Therefore, there is a pressing need to develop/identify anti-fibrotic agents to preserve the filtering bleb and maintain good IOP control.

Human relaxin (RLN2), a 6-kDa peptide hormone, possesses anti-inflammatory, anti-fibrotic, vasodilatory, angiogenic, and cardio-protective actions. The anti-fibrotic activity of RLX2 has been extensively studied in non-ocular fibrotic diseases and not in ocular fibrosis especially glaucoma fibrosis.

Currently, researchers from AMRF have been working on investigating the IOP lowering property and anti-fibrotic properties of plain RLN2 (serelaxin, recombinant relaxin) on TGF $\beta$ 2-induced elevated IOP ex vivo model of glaucoma using Human Organ Cultured Anterior Segment (HOCAS) and also to study the mechanism by which RLN2 mediates its anti-fibrotic activity in fibrosis induced by TGF $\beta$ 2 in the trabecular meshwork. TGF $\beta$ 2 treatment caused 25% reduction in outflow facility and the presence of human relaxin (RLN2) enhanced the outflow facility by 2.2 fold as compared to vehicle treated eyes. Further studies were underway to analyse the mechanism by which relaxin reduces the fibrosis induced by TGF $\beta$ 2 treatment using nCounter Fibrosis assay.

## Microbiology

Fungal keratitis, mainly from *Fusarium spp.* and *Aspergillus flavus*, significantly causes corneal blindness, often needing surgery due to poor antifungal response. The study at AMRF hypothesised that these pathogens have different pathophysiology due to unique immune pathways. While miRNAs regulate gene expression in various corneal diseases, their role in fungal keratitis is unclear. This study examined species-specific gene and miRNA expression in fungal keratitis, identifying pathogen-specific and independent host immune responses triggered by *Fusarium spp.* and *A. flavus*. Findings deepen the understanding of immune dynamics and lay the groundwork for future research,



Library preparation for next-generation sequencing

potentially improving therapies. Moreover, distinct miRNA signatures linked to *Fusarium spp.* and *A. flavus* infections were found, associated with disease progression, and may act as diagnostic and prognostic markers.

The study on the investigation of ocular immuno-inflammatory signatures in uveitis patients suggests that changes in tear proteins may be linked to eye inflammation in uveitis. One specific protein, MIF, exhibits distinct patterns in patients compared to healthy individuals, which could aid in tracking the disease in the future.

## Bioinformatics

AMRF provided researchers with powerful, user-friendly bioinformatics tools to analyse next-generation sequencing (NGS) data with ease. Its in-house computational platform supported the analysis of genomic and exomic data, enabling the identification of key mutations associated with eye diseases. The updated machine learning-based tool was six times faster than older tools in detecting and prioritising eye disease-specific mutations from whole-exome and genome data. In addition, AMRF offered expert data analysis support for transcriptomic, mirnomic, and other omics datasets, assisting scientists across AMRF and its collaborative institutes with their research needs.

## Stem Cell Biology

Stem cells are undifferentiated cells with the ability to self-renew and differentiate into specific types of cells. Each tissue in the human body has adult stem cells that maintain tissue homeostasis throughout life. The focus of research in this laboratory is to understand the basic

biology of adult stem cells in the human eye, elucidate changes with ageing/diseased conditions, and develop better stem cell-based therapies. Studies were being carried out on human (i) trabecular meshwork stem cells in relation to primary open angle glaucoma, (ii) lens epithelial stem cells and age-related cataract, and (iii) retinal pigment epithelial stem cells and age-related macular degeneration.

Previous studies from this laboratory confirmed the loss of trabecular meshwork stem cells in glaucomatous condition and demonstrated that transplantation of the cultured trabecular meshwork stem cells reduced the intraocular pressure in an organ culture model for glaucoma. The exosomes/small extracellular vesicles derived from these stem cells were also identified to enhance trabecular meshwork cell proliferation and to have antioxidant potential. Analysis of their molecular cargo - protein and miRNAs were the identified factors that are associated with these properties. Studies were initiated to establish clinical grade exosomes from trabecular meshwork stem cells, to evaluate their efficacy in tissue regeneration and restoration of normal intraocular pressure in an animal model for glaucoma. In addition to trabecular meshwork stem cells, molecular studies on lens epithelial stem cells and retinal pigment epithelial stem cells have been carried out to understand the molecular regulation of these adult stem cells including transcription factors, microRNAs and associated signalling pathways. Identification of these regulatory factors will enable the development of better methods for expanding the stem cells *in vitro* as well as to activate them *in vivo*.

## Infrastructure Development and Research at Regional Research Centres (RRC)

The Regional Research Centre at Aravind-Tirunelveli was relocated to a new facility with dedicated infrastructure and amenities, inaugurated on 8<sup>th</sup> February 2025. In addition, a new lab with advanced capabilities was established at Aravind-Coimbatore in the year 2025. Along with the existing research centre at Aravind-Pondicherry, these RRCs have been conducting clinical and translational research, serving as a bridge between basic science and clinical innovation in ophthalmology.

Several projects funded by both governmental and non-governmental organisations were initiated and in progress. The RRC at Aravind-Pondicherry conducted an ongoing screening of families for specific mutations related to juvenile open-angle glaucoma, and the project was in progress. Another project on viral keratitis biomarkers was also ongoing.

RRC Coimbatore organised a full-fledged team of clinicians and basic researchers working on several aspects. Aravind Registry for Inherited Diseases of the Eye was one such activity. Developing rapid point of care diagnostics was also being pursued actively.

At the RRC in Aravind-Tirunelveli, the existing project on screening families for glaucoma-specific gene mutations has been expanded, and an additional project studying Down syndrome and its association with ocular diseases has also been initiated.

*Inauguration of the new facility of the Regional Research Centre at Aravind-Tirunelveli*





*Participants of the Extracellular Vesicles Isolation Workshop*



*Participants of the Dartmouth Education and Research Conference*

## Conferences/Workshops conducted

### Two-day workshop on “Extracellular Vesicles: Isolation, Characterisation, and Applications”

24-25 October 2024

Organised as part of the October Summit and Scientific Social Responsibilities (SSR) initiative of the ongoing SERB-SRG project, the workshop was structured into two modules where in the first segment, participants conducted hands-on experiments to isolate extracellular vesicles (EVs) from plasma using two distinct techniques and observed the demonstration of EV isolation from Platelet-Rich Plasma (PRP), and in the second segment, participants performed EV characterisation using Nanoparticle Tracking Analysis (NTA), protein isolation, Western blot, and proteome analysis.

A total of 17 participants, including faculty members, research scholars, and postgraduates from 11 institutions across Tamil Nadu participated.

### Dartmouth Education and Research Conference

3-4 December 2024

Hosted by AMRF in collaboration with Dartmouth University, the conference provided a unique opportunity for both institutions to share educational and research activities, paving the way for future collaborative research projects and long-term partnerships between AMRF and Dartmouth University.

Students from Dartmouth University presented research proposals on various eye diseases to an audience of clinicians, scientists, and research scholars which received high praise from the invited experts. Similarly, AMRF research scholars displayed their work through poster presentations. During lab visits, AMRF scientists showed the core research facilities and explained the ongoing projects to the Dartmouth delegation.

## Ongoing Projects

### Basic research

The application of basic research to solve clinical problems continues to be the primary focus of research at AMRF. Host-pathogen interaction in fungal and bacterial pathogenesis and mechanisms underlying eye disorders were explored in depth. Proteome profiling by mass spectrometry, single-cell RNA analysis, whole genome sequencing, and microbiome interaction were pursued vigorously. Besides laboratory studies, AMRF actively involved in population studies to identify people at risk of early-onset and late-onset glaucoma. Researchers also identified biomarkers that could predict the progression of diabetes to early diabetic retinopathy. These studies will allow the early intervention and prevention of severe sight-threatening disorders. The overall objective of AMRF research activities is to leverage fundamental scientific knowledge for patient care.

- A comparative proteomic analysis of plasma and vitreous humor derived small Extracellular Vesicles (SEVs) from Proliferative Diabetic Retinopathy (PDR) patients.
- A scalable system for the production of human induced pluripotent stem cell derived functional retinal pigmented epithelial cells
- Adult stem cell derived extracellular vesicular miRNAs for trabecular meshwork regeneration in glaucoma
- Adult stem cell derived exosomes: a cell-free therapy for glaucoma
- Analysis of tear MMPs from Down's syndrome patients to assess the predisposition of Keratoconus among Down's syndrome patients
- Attenuation of drug-resistance in Ocular Multidrug-Resistant *Pseudomonas aeruginosa* using human corneal miRNA cargo of Extracellular Vesicles
- Characterization of adult human lens epithelial stem cells in the maintenance of tissue homeostasis throughout life and their functional status in cataractous lens
- Decoding the Unknown Genetic Etiology to Ameliorate the Molecular Diagnosis of Leber's Congenital Amaurosis
- Deciphering predictive and preventive methods in the progression of pterygium using multi-omics approaches
- Development and validation of a non-invasive point-of-care diagnostic tool for fungal keratitis
- Dysregulated human Corneal miRNAs and their role in disease progression
- Early Detection of Glaucoma by Genome Analysis
- Elucidating the role of cancer stem cells in chemoresistant retinoblastoma and their therapeutic implications
- Evaluation of IOP lowering property and Anti-fibrotic property of Relaxin on TGF $\beta$ 2-induced Elevated IOP Ex vivo model of glaucoma using Human Organ Cultured Anterior Segment (HOCAS)
- Expression profiling of human corneal miRNAs and their role in *Pseudomonas aeruginosa* induced keratitis
- Functional repair of mutant RB1 by CRISPR-mediated gene editing in retinal tumor cells of bilateral RB patients
- Identification and Characterization of adult human retinal pigment epithelial stem cells
- Identification of host immune factors as predictor of severe human fungal keratitis and their utility in disease management
- Investigation of nuclear genes involvement in a Mitochondrial Disorder: Leber's Hereditary Optic Neuropathy
- Isolation and Characterisation of Extracellular Vesicles from Human tear film & Multiple isoforms Human Tear lysozyme are localised in the Extracellular Vesicle
- Mitochondrial Association with Transcriptomic signatures for Trabecular Meshwork Damage in Glaucoma: A tissue-specific omics approach
- Modelling macular degeneration using human pluripotent stem cells for better understanding of disease pathophysiology and to investigate novel therapies
- Molecular characterization of ocular lymphoma for improved disease prognosis
- Molecular characterization of human retinal pigment epithelial stem cells and their role in age related macular degeneration
- Molecular regulation of adult human lens epithelial stem cells: changes with aging and cataract
- Molecular regulators associated with the maintenance of human trabecular meshwork stem cells in relation to their reduction in aging and glaucoma
- Prospective Study Analyzing the Role of Cytokine-Mediated IOP reduction in POAG / OHTN Patients Receiving Therapeutic Ultrasound for Glaucoma (TUG) Treatment
- Role of Human Corneal miRNAs in the onset and severity of Fungal Keratitis
- 'Relaxin' the pressure in glaucoma
- Role of vitamin D3, dopamine and serotonin levels in myopia development and progression
- Stress induced alterations in the Extracellular Vesicles of *Aspergillus flavus*
- Understanding the mechanism of action of a novel chemical cross-linker designed to treat keratoconus
- Ocular Macrophage Migration Inhibitory Factor-based stratification and prognostication of patients with vision threatening ocular inflammatory conditions
- Ocular macrophage migration inhibitory factor-based stratification and prognostication of patients with vision threatening ocular inflammatory conditions
- Whole genome sequence analysis of selected family members of the Kadaladi family and identification of markers for the early detection of JOAG using tear extracellular vesicles

## PhD Awarded



R. Kadarkarai Raj  
Genetics  
Thesis: Molecular genetics of ABCA4 gene in patients with retinal dystrophies  
Guide: Dr. P. Sundaresan  
PhD awarded by Alagappa University



A.S. Sree Viswarubhini  
Genetics  
Thesis: Molecular characterisation of Leber's Congenital Amaurosis in South Indian cohort  
Guide: Dr. P. Sundaresan  
PhD awarded by Alagappa University



C. Prakash  
Genetics  
Thesis: Investigating the cross talk between nuclear and mitochondrial genome in patients with Leber's Hereditary optic neuropathy  
Guide: Dr. P. Sundaresan  
PhD awarded by Alagappa University



T. Shanthini  
Molecular Genetics  
Thesis: Molecular characterisation of tumour progression in retinoblastoma  
Guide: Dr. A.Vanniarajan  
PhD awarded by Madurai Kamaraj University

## Clinical research

Aravind Eye Hospitals are actively engaged in both prospective and retrospective clinical studies. These encompass investigator-initiated academic research as well as nationally and internationally funded collaborative studies, including both observational and interventional designs. The overarching objective is to advance eye care by leveraging evidence-based and innovative treatment strategies that have the potential to shape clinical practice and decision-making on a global scale.

All clinical research at Aravind is conducted in accordance with the New Drugs and Clinical Trial Rules, 2019, and the guidelines established by the International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use (ICH), ensuring adherence to the highest standards of ethical and scientific integrity.

### Glaucoma

- A Comparative Study of Surgical Outcomes of Tanito Ab Interno Microhook Trabeculotomy with Phacoemulsification in Primary Open Angle Glaucoma Versus Primary Angle Closure Glaucoma
- A cross sectional study on comparison of lens parameters and choroidal thickness across spectrum of primary angle closure disease and normal population
- A Multi-Center, Prospective, interventional Study Evaluating the Safety and Efficacy of the TUG in Subjects with Primary Open Angle Glaucoma or Ocular Hypertension
- Artificial Intelligence and Machine Learning Analysis of Ophthalmic Data from patients with Primary Glaucoma
- Assessment of Efficacy and Safety of Interventional Valve Enhancing Trabeculotomy with Phacoemulsification in Open Angle Glaucoma
- Assessment of the role of regular voice messages, audio-visual reminders using adherence monitors, and one on one counselling on the adherence to topical medications in patients with glaucoma - A non-randomized study
- Barriers to follow-up and utilization of vision centres in patients with open-angle glaucoma in South India
- Comparison of accuracy in intraocular pressure measurements using re-used ethylene oxide sterilised and new Icare probes
- Comparison of Virtual Reality Based Perimetry with Standard Automated Perimetry in Patients with Glaucoma
- Comparing the Quality of life outcomes between combined Phaco-Trabeculectomy and MIGS-Phaco
- Comparing the surgical outcomes of combined Kahook dual blade versus tanito micro hook trabeculectomy with phacoemulsification in eyes with moderate to advanced glaucoma-A randomised controlled trial (K-Lot Trial)
- Comparing the surgical outcomes of combined KDB phacoemulsification versus NPDS phacoemulsification for advanced glaucoma with coexisting cataract
- Comparison of Ocular biometric Parameters in Patients diagnosed with Nanophthalmos and in patients with Primary Angle Closure Disease
- Enhancing Early Glaucoma Detection through Family Screening to Reduce Glaucoma Related Blindness
- Environmental Assessment of Community-Based Vision Centres Vs. Referral Centre Visits
- Enhancing glaucoma management with at-home tonometry: survey of patient and provider preferences
- Evaluation of Nanodropper-mediated Microdrops vs. Conventional Drops of Netarsudil 0.02%
- Evaluating a novel AI-based fundus camera device for screening glaucoma in the setting of a comprehensive ophthalmology clinic
- Efficacy of Bruch Membrane Opening -Minimum Rim width to distinguish between Glaucomatous Neuropathy versus Non-Glaucomatous Neuropathy
- Family screening of Glaucoma
- Interventions and outcomes following malignant glaucoma: A retrospective analysis
- Prospective study analyzing the role of cytokine mediated IOP reduction in POAG / OHTN patients receiving TUG Treatment
- Post-operative effects of Ripasudil hydrochloride after trabeculectomy on primary glaucoma
- Risk factors for glaucoma following vitreoretinal surgery with tamponade - A Retrospective Analysis
- Real world data collection of VISULAS Green Selective Laser Trabeculoplasty (SLT) in routine office/ Hospital Use
- Screening of Family members of Juvenile open-angle Glaucoma (JOAG) Patients for Myocilin Gene Mutations
- Screening for glaucoma in children with Retinopathy of Prematurity: A Pilot Study
- Timed Instillation of Medicated Eyedrops in Glaucoma Patients
- To evaluate the efficacy and safety of Aurolab Artificial Drainage Implant (AADI) on intraocular pressure reduction in Paediatric patients with refractory glaucoma

### Retina

- A Double Masked, Parallel Group, Randomized, Multicenter, Clinical Study to Compare Efficacy and Safety of Intas Ranibizumab with Lucentis® in Patients with Neovascular (Wet) Age-Related Macular Degeneration (AMD)
- A Double Masked, Parallel Group, Randomized, Multicenter, Clinical Study to Compare Efficacy and Safety of Intas Ranibizumab with Lucentis® in Patients with Neovascular (Wet) Age-Related Macular Degeneration (AMD)
- A Phase 3, Randomized, Double-Blind Parallel Group, Multicenter Study to Compare Efficacy, Safety, Pharmacokinetics, and Immunogenicity of BP05 Versus EU- Approved Lucentis® in Patients with Wet (Neovascular) Age-Related Macular Degeneration
- A Phase III, Prospective, Randomized, Parallel group, Double-blind, Multicenter Study to Compare the Efficacy, Safety, and Immunogenicity of Lupin's Aflibercept with Eylea® in Patients with Neovascular Age-Related Macular Degeneration
- A Prospective, Multi-centre, Single-arm, Phase IV Study to Assess the Safety, Efficacy and Immunogenicity of Ranibizumab Solution for Injection 10 mg/mL (r-DNA Origin) for the Treatment of Neovascular Age-related Macular Degeneration

- A Phase 3, Multicenter, Double-Masked, Randomized, Parallel Group Study to Evaluate the Efficacy and Safety of Intravitreal OTX-TKI (axitinib implant) in Subjects with Neovascular Age Related Macular Degeneration
  - Age Related Macular Degeneration Benchmark Imaging Dataset
  - A study on the differential expression of Piwi-interacting RNAs (piRNA) and altered Piwi-like protein interactions in Diabetic Retinopathy and other retinal conditions
  - Accuracy of smart phone based mydriatic fundus camera in the detection of CMV retinitis
  - A Phase IIIb, Multicenter, Open-Label, Single-Arm Study To Investigate Faricimab (Ro6867461) Treatment Response In Treatment-Naïve, Underrepresented Asian Indian Patients With Diabetic Macular Edema
  - A Phase III, Randomized, Double blind, Parallel Group, Multicenter Study to Compare the Efficacy, Safety and Immunogenicity between Test Aflibercept and Eylea® in Patients with Neovascular (Wet) Age-Related Macular Degeneration (AMD)
  - A Prospective, Multi-center, Single-arm, Phase IV Study to Assess the Safety, Efficacy and Immunogenicity of Ranibizumab Solution for Injection 10 mg/mL (r-DNA Origin) for the Treatment of Neovascular Age-related Macular Degeneration
  - Comparative Analysis of Two Innovative Products Designed Exclusively for Sutureless Scleral Fixation of Intraocular Lenses, “XNIT Device” versus “CM-T Flex Intraocular Lens
  - Comparative analysis of the outcome of large macular holes operated with Platelet Rich Plasma derived exosomes versus Platelet Rich Plasma
  - Detection of diabetic retinopathy in the human eye using thermal imaging
  - Diabetic Retinopathy Microbiome Study-India
  - Efficacy of Autologous Platelet Rich Plasma as Adjuvant Therapy for Acute Postoperative Endophthalmitis – A Prospective Interventional Study
  - Genetic testing and deep phenotyping of Inherited Retinal Diseases (IRDs) in Indian population: A Prospective multicenter study
  - Genetic characterization of Macular Telangiectasia (MacTel) 2 in the Indian population
  - Intra-Silicone Oil Methotrexate as Adjuvant to Pars Plana Vitrectomy for Sub-silicon oil Haemorrhage in Diabetic Tractional Retinal Detachment – A Prospective Interventional Study
  - LASI-DAD ocular imaging study
  - Long-term effects of semaglutide on diabetic retinopathy in subjects with type 2 diabetes
  - Long-term Outcomes of Patients with DME Who Receive Less than 3 Intravitreal Injections in the First Year
  - Prospective Study for Ocular and Systemic Pathologies
  - Performance of a generic artificial intelligence algorithm on a smartphone fundus camera for screening retinal conditions
  - Prevention of Blindness using Digital Technologies at Primary care centres
  - Quality of life in patients with Diabetic Retinopathy in South India, a questionnaire-based cross-sectional study - DR QOL
  - Surgical outcomes of short-term perfluorocarbon liquid (PFCL) tamponade in rhegmatogenous retinal detachment (RRD) eyes with closed funnel configuration.
  - Short-Term PFCL Endo-Tamponade for Giant Retinal Tear Associated Retinal Detachment – Conventional Versus Two- Staged Surgical Approach
  - Short-Term Perfluorocarbon Liquid Tamponade In Familial Exudative Vitreoretinopathy Associated Rhegmatogenous Retinal Detachment With Severe Proliferative Vitreoretinopathy
  - Structured Post-marketing surveillance to collect the safety data of intravitreal aflibercept injection (IVT-AFL) in patients of wet age-related macular degeneration during real world clinical practice.
  - Subjective High-risk Patient Counselling Randomisation Project (SHARP)
  - To evaluate the anatomical and visual outcomes of a staged surgery with intravitreal Bevacizumab and SF6 tamponade for diabetic tractional retinal detachments (TRD) complicated by intractable intraoperative haemorrhage.
- Cornea**
- Analysis of agreement between Corneal Tomography and ASOCT in individuals with Down syndrome with and without keratoconus
  - A Prospective Comparative Observational Study on the Clinical Features, Microbial Profile and Outcomes of Patients with Corneal ulcers referred from vision centers vs Primary Tertiary Center Visit
  - Analysis of Tear protein profile in Herpes simplex viral keratitis
  - A Prospective analysis on the risk factors for Descemet's membrane detachment during Small Incision Cataract Surgery and Phacoemulsification
  - Clinical outcomes of anterior chamber wash with intracameral voriconazole and intrastromal voriconazole of patients with deep stromal fungal keratitis with endoexudates in south India
  - Corneal Impression Membrane (CIM) Sampling for microbial keratitis diagnosis
  - Effect of clinical photo documentation in the management of corneal ulcer
  - Intelligence Smartphone ImaginG Trial - (INSIGHT)
  - Impact of personality on decision making and satisfaction rates among patients undergoing Femtosecond laser and Microkeratome based refractive surgery
  - Identifying Barriers to Timely Keratitis Care: A retrospective analysis of risk factors among patients with corneal ulcers
  - Identifying Barriers to Timely Keratitis Care: A Prospective Questionnaire Based Survey
  - PUTT (Parasitic Ulcer Treatment Trial)
  - Rose Bengal Electromagnetic Activation with Green light for Infection Reduction (REAGIR) Study
  - Rose Bengal Electromagnetic Activation with Green light for Infection Reduction II (REAGIR II) - a pilot study
  - Research Study on the Impact of Early Medical Attention on Recovery from Corneal Injury
  - Randomized control trial to evaluate safety and efficacy of a novel electric eyelid warming device with massager for the management of meibomian gland dysfunction
  - REAGIR (Rose Bengal Electromagnetic Activation with Green light for Infection Reduction)
  - Steroids and cross-linking for Ulcer Treatment
  - To assess the safety and efficacy of posterior chamber phakic intraocular lens (PCPIOL) in patients with high myopia
  - Tear Proteomics in Down syndrome individuals with and without keratoconus
- Cataract**
- Analysis of the performance of EYE STAR 900 biometer in dense cataracts

- Comparison of Endothelial cell loss following cataract surgery performed using active sentry and o zil handpiece
- Impact of pupil size on the Post-op Outcome of Monofocal Toric IOLs
- Impact of repeat hydro dissection after phacoemulsification over cortex removal in cataract surgery.
- Investigating the efficacy and safety of subtenous anesthesia (STA) in various intraocular surgeries (SICS, PHACO, COMBINED)
- To evaluate the safety and performance of new acrylic hydrophobic intraocular lens
- Neutrophil-to-lymphocyte ratio as an inflammatory biomarker of isolated ocular motor cranial nerve palsies in type 2 diabetes mellitus
- Role of Homocysteine in Vasculopathic Cranial Nerve Palsy
- Risk factors and visual outcomes of non-arteritic anterior ischemic optic neuropathy in an Indian population
- Traumatic Optic Neuropathy Treatment study
- To test the reliability of color vision smartphone application with the ishihara chart
- Diagnostic Protocol for Perceptual Visual Difficulties in Children with Cerebral Visual Impairment
- Eye Screening with Portable Vision Screeners for Children with Learning Disabilities
- Feasibility of a software application for use in assessment of Cerebral Visual Impairment
- Re-imagining Education-Accelerated Development (READ) – Pilot Study
- Retrospective Analysis of Surgical Outcomes of Secondary Intraocular Lens Implantation with or Without Posterior Capsule Capture in Paediatric Eyes Following Primary Open Globe Injury Repair

## Neuro

- A pharmacogenomics study to identify genetic risk factors for development of ethambutol optic neuropathy
- Clinical profile and visual outcomes of traumatic optic neuropathy
- Clinical Profile of Ocular Motor Nerve Palsy
- Clinical Profile of Sixth Nerve Palsy
- Clinical Profile of Multiple Nerve Palsy
- Clinical profile and perioperative risk factors for post cataract surgery non-arteritic anterior ischemic optic neuropathy in an Indian population: an emulated target trial
- Comparative Study of Disc Characteristics in Papilledema Due to Idiopathic Intracranial Hypertension (IIH) versus Tumors
- Evaluating the Impact of Body Mass Index on Visual Prognosis in Idiopathic Intracranial Hypertension

## Paediatric

- A prospective, controlled pilot study to assess the feasibility of assessment of functional vision in Cerebral Visual Impairment (CVI)
- Combined unilateral strabismus with cataract surgery (StaCS) for adults with visually significant cataracts and horizontal strabismus: safety, efficacy and predictive factors.
- Comparing the effectiveness of different counselling methods for strabismus surgery in paediatrics: A study of image-based, animation-based, and verbal counselling
- Comparison of Anxiety Among parents of Children with High Myopia and Myopia - A Questionnaire based study
- Current Status of Brock string therapy - consensus among strabismologists and compliance among the patients

## Uvea

- A phase III, multicenter, randomized, double-masked, sham-controlled study to investigate the efficacy, safety, pharmacokinetics, and pharmacodynamics of ro7200220 administered intravitreally in patients with uveitic macular edema
- Investigation of ocular immuno-inflammatory signatures in uveitis patients for prognostication and risk stratification
- Multi-omics Strategies to Improve Clinical Outcomes in Uveitis LOTUS– Leveraging Ocular Tissues in Uveitis Study
- Ocular Macrophage Migration Inhibitory Factor-based stratification and prognostication of patients with vision threatening ocular inflammatory conditions

## Health services research

The research division at LAICO leads health services research efforts across the AECS, focusing on improving the delivery and accessibility of eye care. Key areas of investigation include access to quality care, expanding universal eye care coverage through vision centres, and evaluating the effectiveness of innovative technologies such as telemedicine and artificial intelligence. The division also undertakes population-based studies to assess the prevalence of eye diseases and patterns of service utilisation within communities. In addition, the team conducts systematic reviews and meta-analyses on a range of clinical and non-clinical topics to inform evidence-based practices.

- Cost-Effectiveness of a Community-based Vision Center in Treating Refractive Error and Cataract in South India
- Comparing agreement of iCare vs GAT - A systematic review and meta-analysis
- Efficacy of phacotrabeculectomy in pseudoxfoliation glaucoma - A Systematic Review and Meta-analysis
- Evaluating the association of Manual Small Incision Cataract surgeries and surgically induced astigmatism: A systematic review and meta-analysis
- Examining the Safety and Efficacy of an Altered Post-OP Follow-up Protocol following an uneventful cataract surgery at a Tertiary Eye Care Hospital in Bangladesh - A Randomised Controlled Trial
- Eye injury rates and community cost savings through Vision Centers: Evidence from southern India
- Impact of Vision Centres on Achieving Universal Eye Health Coverage: Prevalence, Coverage, and Utilisation of Eye Care Services in Southern India
- Impact of Electronic Medical Record Implementation on Care Provider and Patient Satisfaction in an Indian Tertiary Level Eye Hospital Network
- Prevalence of Glaucoma in India - A systematic review and meta-analysis
- Prevalence and Risk Factors for Glaucoma in Nanophthalmos - A Systematic Review and Meta-analysis
- Rapid Assessment of Avoidable Blindness Survey in Kanniyakumari District