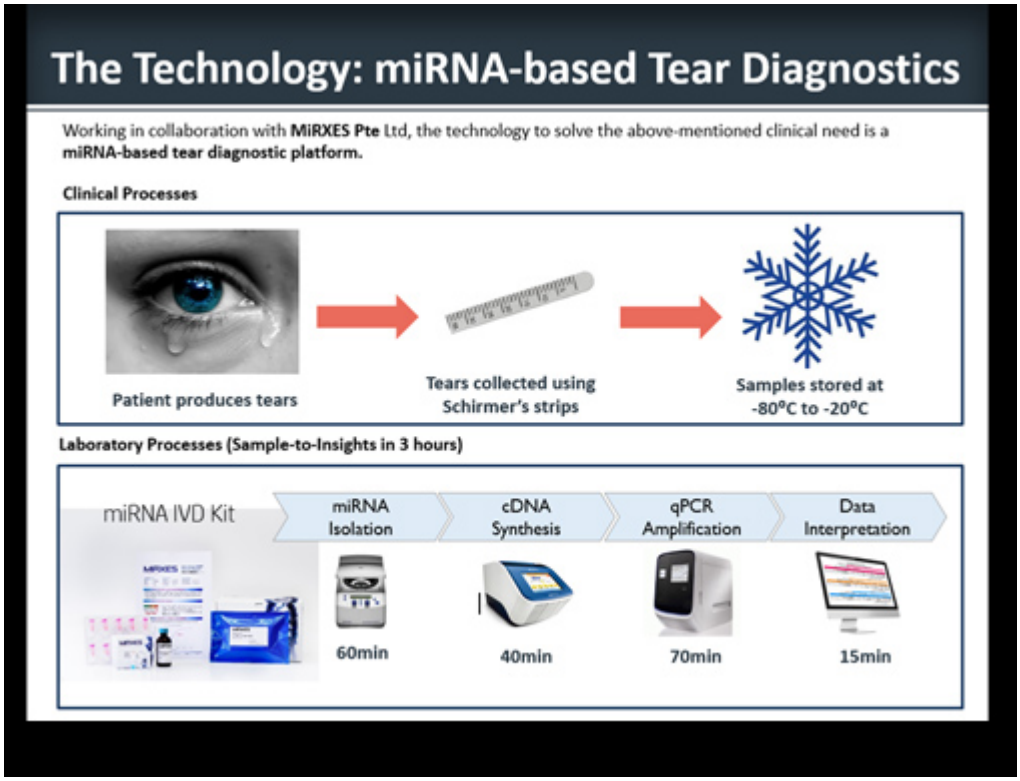
Research

miRNA based biomarkers for Diabetic Macular Oedema (DME)

Diabetic retinopathy (DR) is the leading cause of blindness among working adults globally. The current gold-standard treatment for DME involvs monthly intravitreal administration of anti-VEGF such as Avastin®, Eyelea® and Lucentis®. However, about 25% of DME patients experience only a moderate improvement in vision, whilst another 25% of DME patients show no response at all (non-responders). It takes many months (i.e multiple injections of up to 10 each year) to determine a need for switch in therapy. This belies a need to need to (1) Identify biomarkers for patient stratification and (2) Identify novel targets for disease therapeutics. In collaboration with MiRXES, we aim to develop a non-invasive tear-based miRNA kit to differentiate between responder and non-responder patients, as a tool to guide ophthalmologists in their clinical practice.



<u>OrBID (OculaR Biomaterials and Device): A Biomaterials (polymer) platform providing clinical solutions for retinal disease</u>

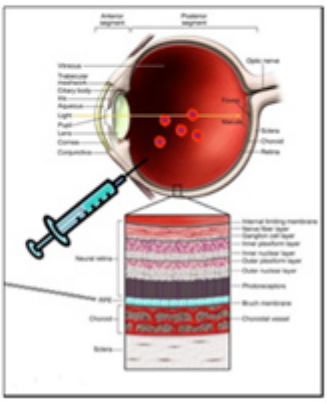
This program is aimed at developing a hydrogels-based biomaterials platform to solve unmet clinical needs in ophthalmology. Our focus is on developing polymers for vitreo-retinal applications, such as **(i) <u>Sustained intravitreal drug delivery</u>**, **(ii) <u>Vitreous substitutes</u>**: as internal tamponade agents after vitrectomy and **(iii) <u>Retinal cellular therapeutics</u>:** surgical adjuncts for subretinal RPE transplantation.

OrBID

OculaR BIomaterials and Devices

A biomaterials (polymer) platform providing clinical solutions for retinal disease

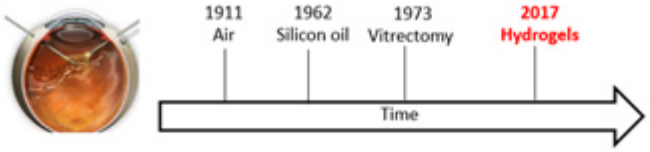
1. **Retinal drug delivery**
   - Intravitreal: Sustained release
   - Sub-conjunctival/sub-tenons depot device
   - Topical
2. **Vitreous substitutes**
   - Internal tamponade agent after vitrectomy surgery
3. **Retinal cellular therapeutics**
   - Hydrogels as surgical adjuncts for subretinal RPE transplant
   - Drug release and biophysical properties to regulate cell viability, differentiation and migration



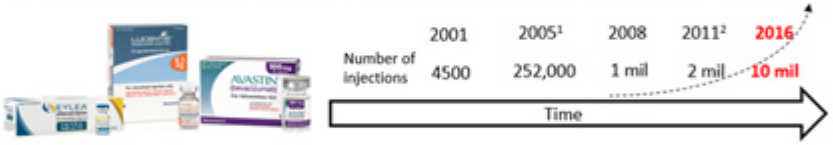
Sustained intravitreal drug delivery of biologics, in particular to the back of the eye, is the holy grail of ocular therapeutics. However a suitable drug delivery vehicle has remained elusive due to the lack of ideal biomaterials. Similarly, current agents used for **medium and long-term tamponade** after vitreo-retinal surgery, such as expansile gases and silicone oil, have been around since the 1960s. Despite their inherent limitations, they have not been replaced due to a lack of better alternatives. Lastly, **stem cell transplantation** is seen as the future of retinal therapeutics for vision recovery in treatment of AMD. As this is an emerging field, there is still a lack of suitable vitreo-retinal surgical adjuncts for cell transfer and to augment functional cell integration after sub-macular stem cell delivery surgery.

We propose that **hydrogels (hydrophilic polymers)**, which are optically clear and strongly resemble the natural vitreous, are promising alternatives to existing materials. Our collaborators at IMRE, Dr Loh Xian Jun has demonstrated in extensive publications, the ability to synthesize a wide range of proprietary functional, biodegradable and thermosensitive hydrogels. Of significance, we have demonstrated that our thermogel is able to retain its structure and tensile strength despite injection through a small bore needle as employed during vitreo-retinal surgery. We have also demonstrated preliminary proof of concept that our thermogel is an effective internal tamponade using a non-human primate retinal detachment surgery model, with no long-term toxicity to the retina.

Hydrogels solve age-old problems of vitreous tamponades



Hydrogel based sustained drug delivery, addresses exponential growth in IVT injections



[1] anti VEGF; rambizumab introduced, [2] Eylea introduced

Hydrogels are surgical adjuncts for up-and-coming retinal stem cell therapy