Novel Nanoemulsions for Intra-ocular Delivery of Mitoprotective Drugs

Team 24: **Matthew Reynolds-Tejeda, Cedric Salame**

Technical Advisors: **Leo Kim (Massachusetts Eye and Ear - Harvard Ophthalmology), Magali Saint-Geniez (Novartis Institutes for BioMedical Research)**

Age-related macular degeneration (AMD) represents the major cause of irreversible vision loss in elderly populations and is characterized by the progressive degeneration of the retinal pigment epithelium, the primary support of the photoreceptors. Currently there is no treatment for the early stage of the pathology, dry AMD, and there is sub-optimal treatment for the advanced stage, wet AMD. Previous work in the lab has identified a compound, ZLN005, as a potent antioxidant able to normalize mitochondrial activity to rescue retinal pigment epithelial degeneration and/or block choroidal neovascularization. However, the application of the compound in-vitro and in-vivo has been hindered by its low solubility in aqueous environments. Nanoemulsions (NEM), which are composed of an oil core and an emulsifier shell, have been shown to improve the biodistribution of such drugs; therefore, we propose the encapsulation of ZLN005 within a NEM. The NEMs are formed using a probe tip sonicator and then characterized by dynamic light scattering, which informs on size, polydispersity index, and zeta potential. We have optimized the composition of the NEMs and encapsulated ZLN005 in our best formulations. We then treated human retinal pigment epithelial cells with drug-loaded NEMs in-vitro to correctly quantify the therapeutic effect of ZLN005 when delivered by the nanocarriers. Furthermore, it becomes possible to treat AMD through a topical application of drug loaded NEMs.