Background Reading Presentation

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Quick Project Recap

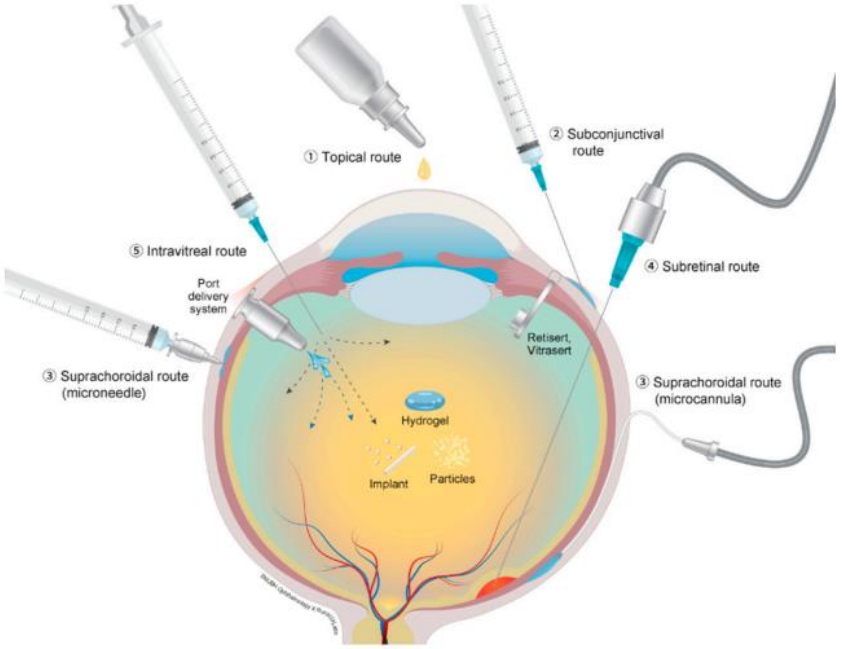


Figure 1. Schematic of several ocular drug administration routes: (1) topical route, (2) subconjunctival route, (3) suprachoroidal route with microcannula and microneedle, (4) subretinal route, and (5) intravitreal injection and port delivery system.

The snare in this project is to provide a curvature that fits the curvature of the shape of eye.

The snare will provide foundation to perform drug delivering to the backside of retina (similar to method 4 showed in figure).

Figure 1: Kim HM, Woo SJ. Ocular Drug Delivery to the Retina: Current Innovations and Future Perspectives. Pharmaceutics. 2021;13(1). doi:10.3390/pharmaceutics13010108

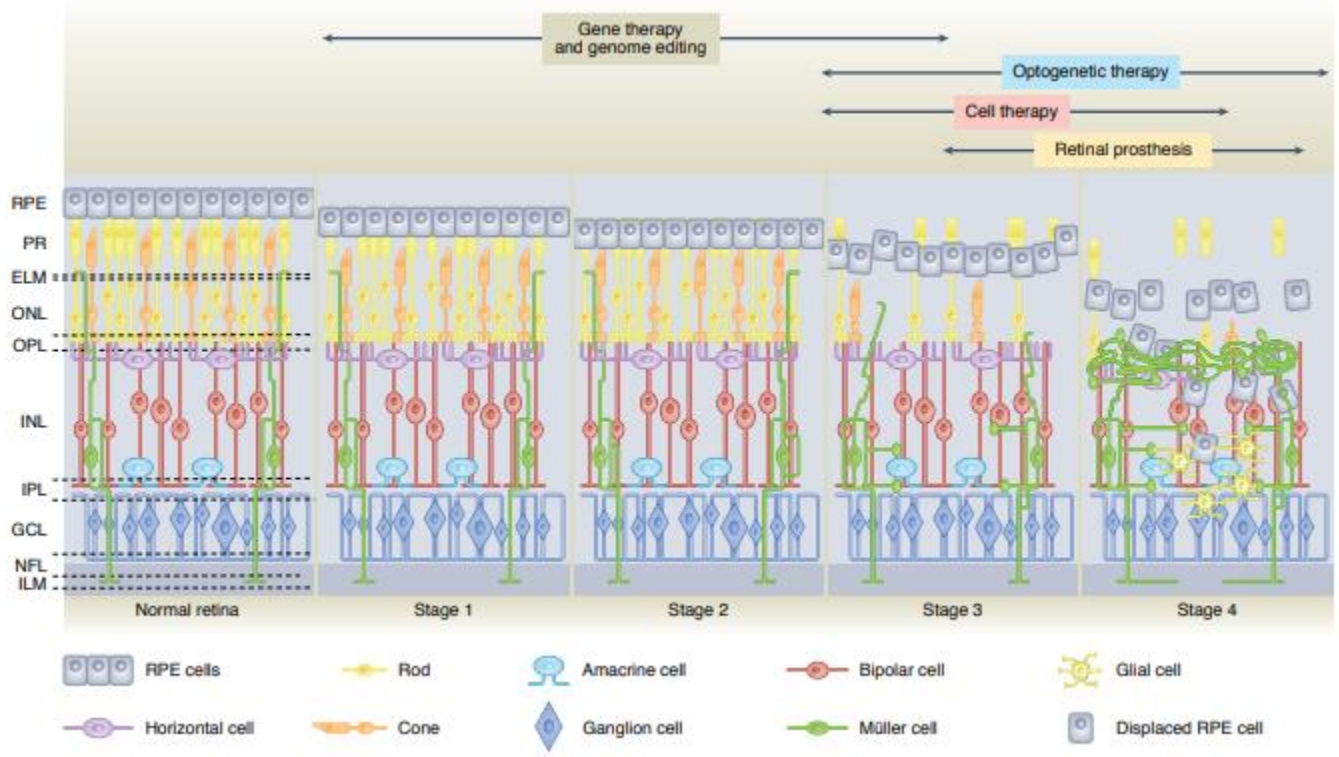
Paper Selected

“Bioengineering strategies for restoring vision”

- Jasmina Cehajic-Kapetanovic, Mandeep S. Singh , Eberhart Zrenner， and Robert E. MacLaren

This paper provides a board introduction on the methods that can be performed to the eye and those corresponding medicines.

Paper Content 1



Cehajic-Kapetanovic J, Singh MS, Zrenner E, MacLaren RE. Bioengineering strategies for restoring vision. Nature biomedical engineering. January 2022. doi:10.1038/s41551-021-00836-4

Paper Content 2

- Gene therapies
  - Gene-replacement therapy
  - Genome editing
  - Optogenetic therapy

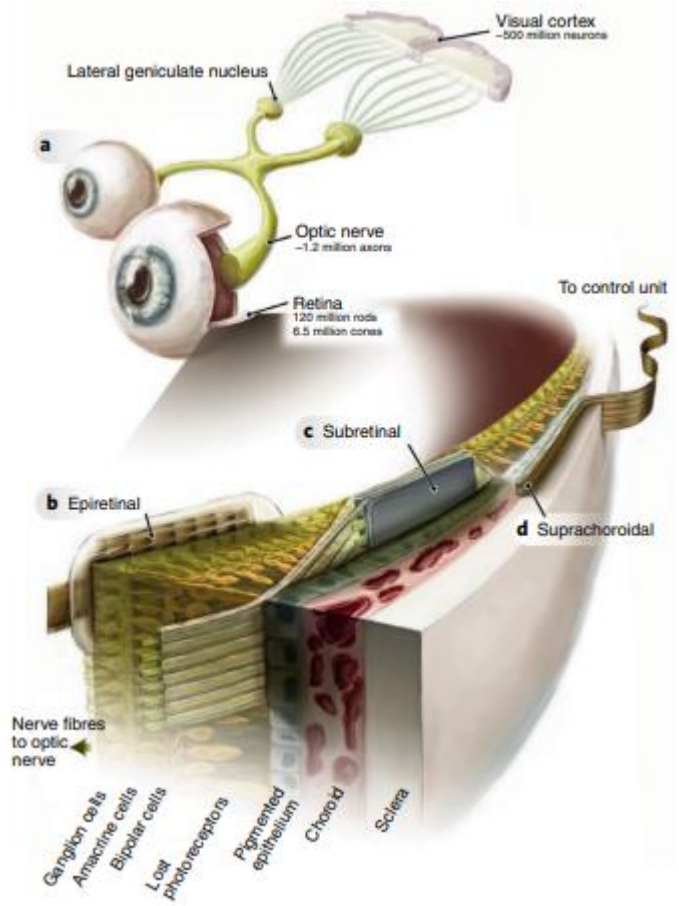
  - Gene-replacement therapy involves the delivery of a normal copy of a mutated gene into the nucleus of host cells using delivery vectors.
  - Gene-editing techniques can be used to treat disease that are challenging in using conventional gene-replacement therapy.
  - Optogenetic is mainly for the late-stage retinal degeneration, which will introduce light-sensitive proteins in the membrane of non-light-sensitive downstream neurons, and it could restore vision.

Paper Content 2

- Retinal and cortical prostheses

3 approaches in implanting:

- Epiretinal implants
- Subretinal implants
- Suprachoroidal implants



Related Method to Project

Cell Therapy:

- envisioned as a future treatment for degenerative retinal diseases

- paracrine therapy
  - centres on the concept that transplanted cells release diffusible factors that promote the viability or function (or both) of existing photoreceptor cells
- cell-replacement therapy
  - replaces either RPE or photoreceptors

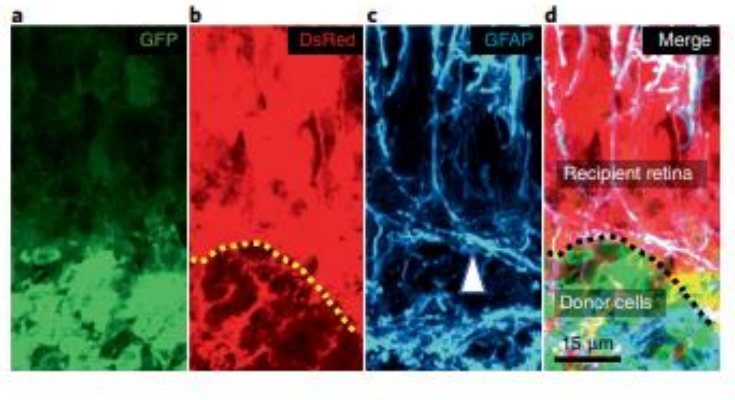


Fig. 4 | Subretinal transplantation of Nrl–GFP donor cells into *rd*^{1}–DsRed mice with advanced photoreceptor-layer atrophy. a,**b**, Nrl–GFP donor cells (green) transplanted into the subretinal space of *rd*^{1}–DsRed (red) mice. **c**,**d**, Müller-cell processes, identified by the expression of glial fibrillary acid protein (GFAP), form a horizontally oriented barrier (arrowhead) between donor and recipient cell layers. The dashed lines delineate the boundary between donor and recipient tissue.

Assessment of Related Method

Pros:

- cell-based biologics appear to be well-tolerated
- do not seem to be associated with notable inflammation or tumorigenesis
- improved visual acuity and fixation in individual cases at or near the site of the grafted cells

Cons:

- must be interpreted with caution until phase-III data are obtained from studies that are adequately powered to detect improvements in a relevant primary-outcome measure
- challenging to speculate on the level of visual improvement that can be anticipated with retinal cell therapy

Reference

Cehajic-Kapetanovic J, Singh MS, Zrenner E, MacLaren RE. Bioengineering strategies for restoring vision. Nature biomedical engineering. January 2022. doi:10.1038/s41551-021-00836-4