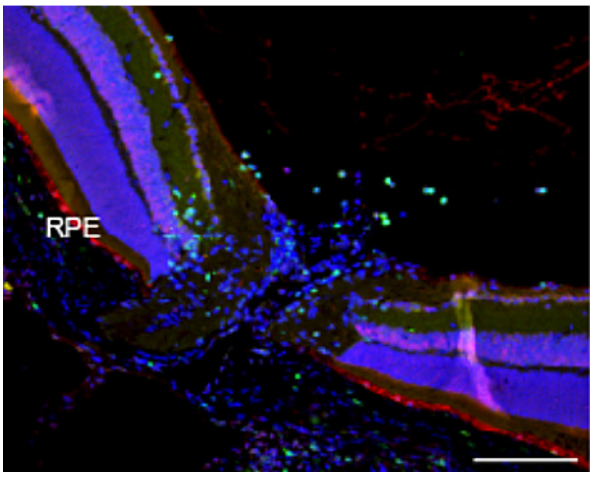
Atlas of Science
another view on science
http://atlasofscience.org

Eye opener: the gate for immune cells entering the injured eye

Disease or injury to the retina or optic nerve is one of the main causes of blindness worldwide. As such, major research efforts have been invested in finding ways to protect the neuronal cells of the retina or to promote the formation of new cells, in the aim of preserving or restoring vision. We know today that certain types of immune cells, namely, monocyte-derived macrophages, can fulfill such protective and regenerative functions within the retina. However, it appears that under pathological conditions, in the absence of any intervention, the extent of trafficking of these cells from the circulation into the retina and/or their activity are not optimal to achieve substantial recovery.



Immune cells (labeled green) entering the eye after injury to the optic nerve. The layers of the retina are shown in blue and the retinal pigment epithelium (RPE) is labeled red. Scale bar: 100 μm. Adapted from the original publication by Benhar et al. in EMBO J 2016.

Attempts at understanding what limits the entry of such beneficial immune cells have highlighted the possibility that they are actively and selectively recruited to the retina through a unique zone within the eye territory, the retinal pigment epithelium (RPE, for short), which controls both their numbers and activity. We addressed this potential mechanism in our recent paper in the EMBO Journal, in which we monitored the response of the RPE to ocular injury. Indeed, we found that the RPE responds to two different types of retinal injury with a higher expression of molecules that mediate the entry of immune cells into tissues. We observed that the numbers of immune cells in the retina were reduced when we blocked one of these molecules. Using a microscopic imaging approach that allows us to look into the retina of a live mouse, we could track monocytes as they sequentially appear in the RPE and then enter the retina. When we injected monocytes directly into the injured retina, circumventing the entry route, we could find that some of them nevertheless came in contact with the RPE from within the eye. In this scenario, more retinal neurons were protected from dying as a result of the injury that they had sustained.

Future studies should interrogate the fate of the immune cells when they encounter the microenvironment of this potential entry route, how it determines their activity in the tissue, and why the spontaneous response evoked by injury it is not enough for significant recovery and repair to take place. Further

understanding of the way immune cells enter the eye and how this affects their function is likely to lead to ways to promote the entry of beneficial immune cells, and ultimately help protect vision.

Benhar Inbal *and* ***Schwartz Michal***
Department of Neurobiology
Weizmann Institute of Science
Rehovot, Israel

Publication

The retinal pigment epithelium as a gateway for monocyte trafficking into the eye.
Benhar I, Reemst K, Kalchenko V, Schwartz M
EMBO J. 2016 Jun 1