**Project Title:** Restoration of the Retinal Structure and Function after Injury  
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**Background:** With the growing prevalence of injury from the improvised explosive devices (IED) the potential for eye damage has increased. Shear forces inflicted by explosion or head impact may result in traumatic retinopathy due to damage of retinal pigment epithelium (RPE) and photoreceptors, leading to loss of sight. Similar injury to photoreceptors and RPE can be induced by exposure to a short pulse laser. Currently there is no therapy for such blind spots (scotomata), and the loss of sight is permanent.

**Objective:** This study will focus on development of strategies for reduction or even elimination of retinal scotomata and scarring based on our recent discovery of the adult retinal plasticity. Specifically, the PI will explore a possibility of redistributing the photoreceptors from the neighboring areas using selective laser therapy. Precise laser exposures can activate glial cells leading to their contractile response, pulling photoreceptors from adjacent areas into the damaged zone. Shifting photoreceptors then rewire to the local inner retinal neurons, restoring retinal sensitivity in the damaged zone. This process results in contraction or even complete elimination of the scotoma, and restoration of retinal structure and function.

**Hypothesis:** Traumatic retinal scotomata can be reduced or even eliminated using this mobility of photoreceptors and associated retinal plasticity.

**Specific Aims:**

- **Aim 1:** Establish a model of traumatic retinopathy by creating large scotomata using selective laser coagulation of RPE and photoreceptors in rabbits and rats.  
- **Aim 2:** Apply selective laser treatment to shift photoreceptors from the adjacent areas into the scotoma.

**Study Design:** Visual scotomata are often caused by holes in the photoreceptor mosaic due to degenerative diseases or ocular traumas. This project explores the finding that one can perhaps redistribute the photoreceptors from the neighboring areas using selective laser therapy. The photoreceptors then rewire with inner-retinal neurons.

**Relevance:** Shear forces inflicted by explosion or head impact may result in traumatic retinopathy due to damage of retinal pigment epithelium and photoreceptors. Currently there is no therapy for traumatic retinopathy, and the loss of sight in the scotomata is permanent. Selective retinal therapy will shift photoreceptors from the surrounding intact areas into the damaged zone and thereby will allow for restoration of retinal structure and function, leading to restoration of sight.