Deafferented mouse rod bipolar cells extend their dendrites towards healthy photoreceptors

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Purpose: Previous studies have demonstrated constructive retinal plasticity in rabbit retina in response to selective ablation of a small patch of photoreceptor by laser. Since searching for molecular mechanisms of such neural plasticity is easier in the mouse, we ablated patches of photoreceptors in the mouse retina and observed the changes in the retinal anatomy over time.

Methods: Round lesions of Barely Visible clinical grade were produced in-vivo in the mouse retina with a 532-nm laser, using 200μm spot diameter and 20ms pulse duration. Photoreceptor migration and changes in the morphology of the deafferented rod bipolar cell (RBCs) were assessed using confocal microscopy of immunostained tissue. RBCs and their synaptic contacts with photoreceptors were visualized with PKCa and ribeye antibodies.

Results: Over time (3-60 days after photocoagulation), healthy photoreceptors migrate into the lesioned area. During this process, RBCs change their morphology: first they lose thinner processes, leaving one or two dendrites, which then expand. These thickened dendrites extend towards the healthy photoreceptors located around the lesion.

Conclusions: Deafferented mouse rod bipolar cells can restructure their dendritic trees to form new connections with healthy photoreceptors. Mouse, with the broad range of its genetic control, can be used to study molecular mechanisms behind the constructive retinal plasticity.