COLLOQUIA IN PHYSIOLOGY AND VASCULAR BIOLOGY

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Wednesday 23.04.2014 11:00 c.t. **Thomas Euler** (host: A. Koschak)

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"Synaptic Remodeling Generates Synchronous Oscillations in the Degenerated Outer Mouse Retina"

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Abstract.
During neuronal degenerative diseases, neuronal microcircuits undergo severe structural alterations, leading to remodeling of synaptic connectivity. The functional consequences of such remodeling are mostly unknown. For instance, in mutant rd1 mouse retina, a common model for Retinitis Pigmentosa, rod bipolar cells (RBCs) establish contacts with remnant cone photoreceptors (cones) as a consequence of rod photoreceptor cell death and the resulting lack of presynaptic input. To assess the functional connectivity in the remodeled, light-insensitive outer rd1 retina, we recorded spontaneous activity in retinal wholemounts using Ca^{2+} imaging and identified the participating cell types. Focusing on cones, RBCs and horizontal cells (HCs), we found that these cell types display spontaneous oscillatory activity and form synchronously active clusters. Overall activity was modulated by GABAergic inhibition from HCs. Many of the activity clusters comprised both cones and RBCs. Opposite to what is expected from the intact (wild-type) cone-ON bipolar cell pathway, cone and RBC activity was positively correlated and, at least partially, mediated by glutamate transporters expressed on RBCs. Deletion of gap junctional coupling between cones reduced cluster number, indicating that electrical cone coupling plays a crucial role for generating the observed synchronized oscillations. In conclusion, degeneration-induced synaptic remodeling of the rd1 retina results in a complex self-sustained outer retinal oscillatory network, that complements (and potentially modulates) the recently described inner retinal oscillatory network consisting of amacrine, bipolar and ganglion cells.

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