Title: Phagocytosis of photoreceptor outer segments by retinal pigment epithelium imaged in living zebrafish

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Abstract
Light absorbing photoreceptor cells at the back of the eye need to renew 10% of their outer segments (OS) every day to maintain normal functionality. Retinal pigment epithelium (RPE) helps to renew photoreceptors by phagocytosing aged OS particles. Failure in this interaction is often the underlying cause for several retinal diseases. RPE phagocytosis is a complex process but detailed understanding on the dynamics of OS particle intake and degradation within RPE as well as differences between photoreceptor types is presently inadequate hindering the development of effective treatments. Previously, RPE phagocytosis has been studied with isolated tissues without physiological context within an entire animal. For the first time, we present RPE phagocytosis event imaged in a living animal.

Zebrafish is one of the most accessible models to study retinal physiology *in vivo*. They have four cone photoreceptor types in addition to one type of rods providing an excellent model to study the possible differences in phagocytosis between photoreceptor types. By utilizing already existing transgenic lines and microinjecting photoreceptor and RPE cell membrane targeted plasmid constructs, we have created low-pigmented fish with fluorescently tagged RPE cells and photoreceptor outer segments. We present our latest results of time-lapse confocal imaging on an anesthetized zebrafish to show how an OS particle moves from photoreceptor outer segment deeper into an RPE cell until vanishing upon degradation. Our results provide a new approach to study RPE-photoreceptor interactions within a living animal, with increasing possibilities with other tissues as we all as eye disease modelling.