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# Light propagation in retinal tissue and in silico

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Light penetration and formation of image inside biological tissues is of physiological relevance in the eye and practical importance in the context of tissue and whole organism microscopy. We present here how the vertebrate retina, having a counter intuitive inverted structure deals with incoming light. We show by direct transmission measurements how the unique chromatin arrangement within photoreceptor nuclei impacts image quality at the level of the photoreceptors. The experimental findings are complemented by wave optical simulations of forward scattering. The simulations from the anatomically faithful tissue models successfully predicts the loss of image contrast due to the large angle scattering occurring in the tissue and also provides a physical and mechanistic understanding of the image formation process.

We further show, how these simulations can also be used to mimic the imaging process in tissue microscopy. Our open source software, biobeam [1] has the flexibility to implement multiple modalities ranging from laser scanning to light sheet fluorescence imaging. It can reproduce aberrations, distortions, adaptive optical effects and most intricate wave optical phenomena relevant to microscopy. With the multiplexed, GPU accelerated implementation of the in silico light propagation our software pushes the frontiers of computer model guided microcopy enabling highest resolution deep tissue imaging.

[1] Weigert, Martin, Kaushikaram Subramanian, Sebastian T. Bundschuh, Eugene W. Myers, and Moritz Kreysing. "Biobeam—Multiplexed wave-optical simulations of light-sheet microscopy." PLoS computational biology 14, no. 4 (2018): e1006079.

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## Terms and Conditions

Yes

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