

Abstract Submitted
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Material Structure of a Graded Refractive Index Lens in Decapod Squid JING CAI, PAUL HEINEY, ALISON SWEENEY, University of Pennsylvania — Underwater vision with a camera-type eye that is simultaneously acute and sensitive requires a spherical lens with a graded distribution of refractive index. Squids have this type of lens, and our previous work has shown that its optical properties are likely achieved with radially variable densities of a single protein with multiple isoforms. Here we measure the spatial organization of this novel protein material in concentric layers of the lens and use these data to suggest possible mechanisms of self-assembly of the proteins into a graded refractive index structure. First, we performed small angle x-ray scattering (SAXS) to study how the protein is spatially organized. Then, molecular dynamic simulation allowed us to correlate structure to the possible dynamics of the system in different regions of the lens. The combination of simulation and SAXS data in this system revealed the likely protein-protein interactions, resulting material structure and its relationship to the observed and variable optical properties of this graded index system. We believe insights into the material properties of the squid lens system will inform the invention of self-assembling graded index devices.

Jing Cai
University of Pennsylvania

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