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Polarization based imaging of amyloid in the retina gives a biomarker of severity of Alzheimer's disease

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The retina, with its neural tissue, also acts as a window on the brain. Alzheimer's disease is currently only definitively diagnosed after death from an analysis of deposits of amyloid beta (plaques) in the brain. Retinal function has been reported to be directly affected by the disease and neurotoxic effects of amyloid beta have been demonstrated in the retina. We were one of the first groups to find amyloid deposits in association with neural cells in *ex vivo* retinas of those with Alzheimer's disease. Using Mueller matrix polarimetry, and taking 16 images as we rotate quarter wave plates with respect to linear polarizers within a polarization state generator and analyzer, we can identify the presence of the disease with high sensitivity and specificity without the use of a dye. A number of interactions of the deposits with polarized light differ from those of the surrounding tissue. One of the largest differences is in the birefringence of the amyloid deposits. This gives rise to relative retardation of two perpendicular linear polarizations and contrast in cross polarization. In our hands, polarization imaging of the retina provides a noninvasive, less expensive and simple method of detecting and tracking amyloid deposits. In addition, we have shown that the number of deposits can predict the severity of Alzheimer's disease. Here we will describe the similarity of polarimetry measurements on pure amyloid beta and deposits in retinal tissue. We will then describe our intended instrument configuration for imaging these deposits in the living eye.

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