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Rhodopsin Photoactivation Dynamics Revealed by Quasi-Elastic Neutron Scattering DEBSINDHU BHOWMIK, UTSAB SHRESTHA, Wayne State University, MI, SUCHHITHRANGA M. C. D. PERERA, UDEEP CHAWLA, University of Arizona, AZ, EUGENE MAMONTOV, Oak Ridge National Laboratory, TN, MICHAEL BROWN, University of Arizona, AZ, XIANG-QIANG CHU, Wayne State University, MI — Rhodopsin is a G-protein-coupled receptor (GPCR) responsible for vision. During photoactivation, the chromophore retinal dissociates from protein yielding the opsin apoprotein. What are the changes in protein dynamics that occur during the photoactivation process? Here, we studied the microscopic dynamics of dark-state rhodopsin and the ligand-free opsin using quasielastic neutron scattering (QENS). The QENS technique tracks individual hydrogen atom motion because of the much higher neutron scattering cross-section of hydrogen than other atoms. We used protein with CHAPS detergent hydrated with heavy water. The activation of proteins is confirmed at low temperatures up to 300 K by mean-square displacement (MSD) analysis. The QENS experiments at temperatures ranging from 220 K to 300 K clearly indicate an increase in protein dynamic behavior with temperature. The relaxation time for the ligand-bound protein rhodopsin is faster compared to opsin, which can be correlated with the photoactivation. Moreover, the protein dynamics are orders of magnitude slower than the accompanying CHAPS detergent, which unlike protein, manifests localized motions.

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