Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Transmembrane protein CD93 diffuses by a continuous time random walk.[1] MARIA GOIKO, JOHN DE BRUYN, BRYAN HEIT, The University of Western Ontario — Molecular motion within the cell membrane is a poorly-defined process. In this study, we characterized the diffusion of the transmembrane protein CD93. By careful analysis of the dependence of the ensemble-averaged mean squared displacement (EA-MSD, r^2) on time t and the ensemble-averaged, time-averaged MSD (EA-TAMSD, δ^2) on lag time τ and total measurement time T, we showed that the motion of CD93 is well-described by a continuous-time random walk (CTRW). CD93 tracks were acquired using single particle tracking. The tracks were classified as confined or free, and the behavior of the MSD analyzed. EA-MSDs of both populations grew non-linearly with t, indicative of anomalous diffusion. Their EA-TAMSDs were found to depend on both τ and T, indicating non-ergodicity. Free molecules had $r^2 \propto t^\alpha$ and $\delta^2 \propto (\tau/T^{1-\alpha})$, with $\alpha \approx 0.5$, consistent with a CTRW. Mean maximal excursion analysis supported this result. Confined CD93 had $r^2 \propto t^0$ and $\delta^2 \propto (\tau/T)^\alpha$, with $\alpha \approx 0.3$, consistent with a confined CTRW. CTRWs are described by a series of random jumps interspersed with power-law distributed waiting times, and may arise due to the interactions of CD93 with the endocytic machinery.

[1]NSERC

Maria Goiko
The University of Western Ontario

Date submitted: 09 Nov 2016 Electronic form version 1.4