α-TOCOPHEROL IS WELL-DESIGNED TO PROTECT POLYUNSATURATED PHOSPHOLIPIDS: MD SIMULATIONS

Xiaoling Leng[1], Jacob J. Kinnun[1], Drew Marquardt[2,3], Mikel Ghefli[4], Norbert Kučerka[5,6], John Katsaras[7-9], Jeffrey Atkinson[4], Thad A. Harroun[2], Scott E. Feller[10]and Stephen R. Wassall[1*]

[1]Department of Physics, Indiana University Purdue University Indianapolis, Indianapolis, IN 46202-3273, USA; [2]Department of Physics, Brock University, St.Catharines, ON L25 3A1, Canada; [3]Institute of Molecular Biosciences, University of Graz, A-8010 Graz, Austria; [4]Department of Chemistry, Brock University, St. Catharines, ON L25 3A1, Canada; [5]Canadian Neutron Beam Centre, National Research Council, Chalk River, ON K0J 1J0, Canada; [6]Faculty of Pharmacy, Comenius University, 832 32 Bratislava, Slovakia;[7]Neutron Sciences Directorate, Oak Ridge National Laboratory, Oak Ridge, TN 37831-6100, USA, [8]Joint Institute for Neutron Sciences, Oak Ridge, TN 37831, USA;[9]Department of Physics and Astronomy, University of Tennessee, Knoxville, TN 37996, USA; and [10]Department of Chemistry, Wabash College, Crawfordsville, IN 47933, USA

Supporting Material

Table S1: The surface area per lipid calculated from the average bilayer size during the MD simulations on SDPC and SOPC bilayers in the absence and presence of 20 mol% αtoc at 37 °C.

Lipid	SDPC	SDPC+αtoc	SOPC	SOPC+αtoc
Area/lipid ($Å^2$)	71.7 ± 0.2	62.4 ± 0.2	65.7 ± 0.3	58.7 ± 0.2

The uncertainties are the standard error of the areas.

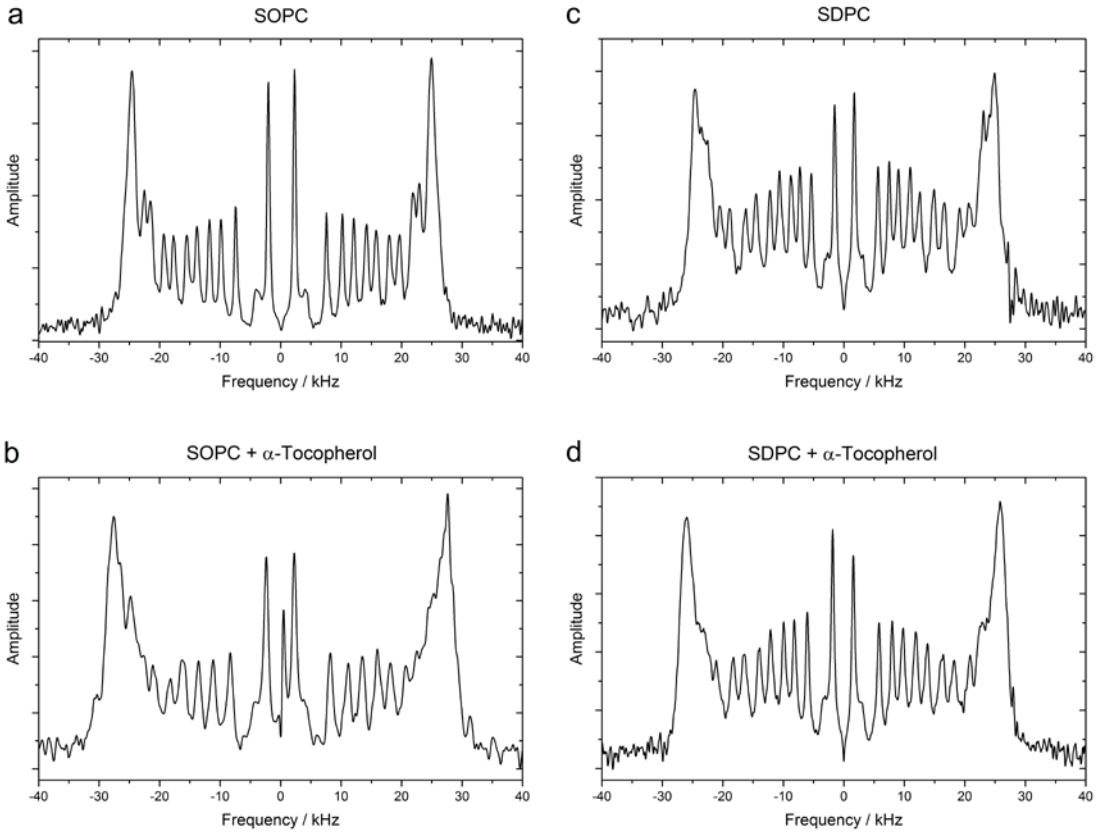

Figure S1 FFT depaked ^{2}H NMR spectra for 50 wt% aqueous dispersions in 50 mM Tris buffer (pH 7.5) of (a) SOPC-d_{35}, (b) SOPC-d_{35} + 20 mol% αtoc, (c) SDPC-d_{35} and (d) SDPC-d_{35} + 20 mol% αtoc at 37 °C.

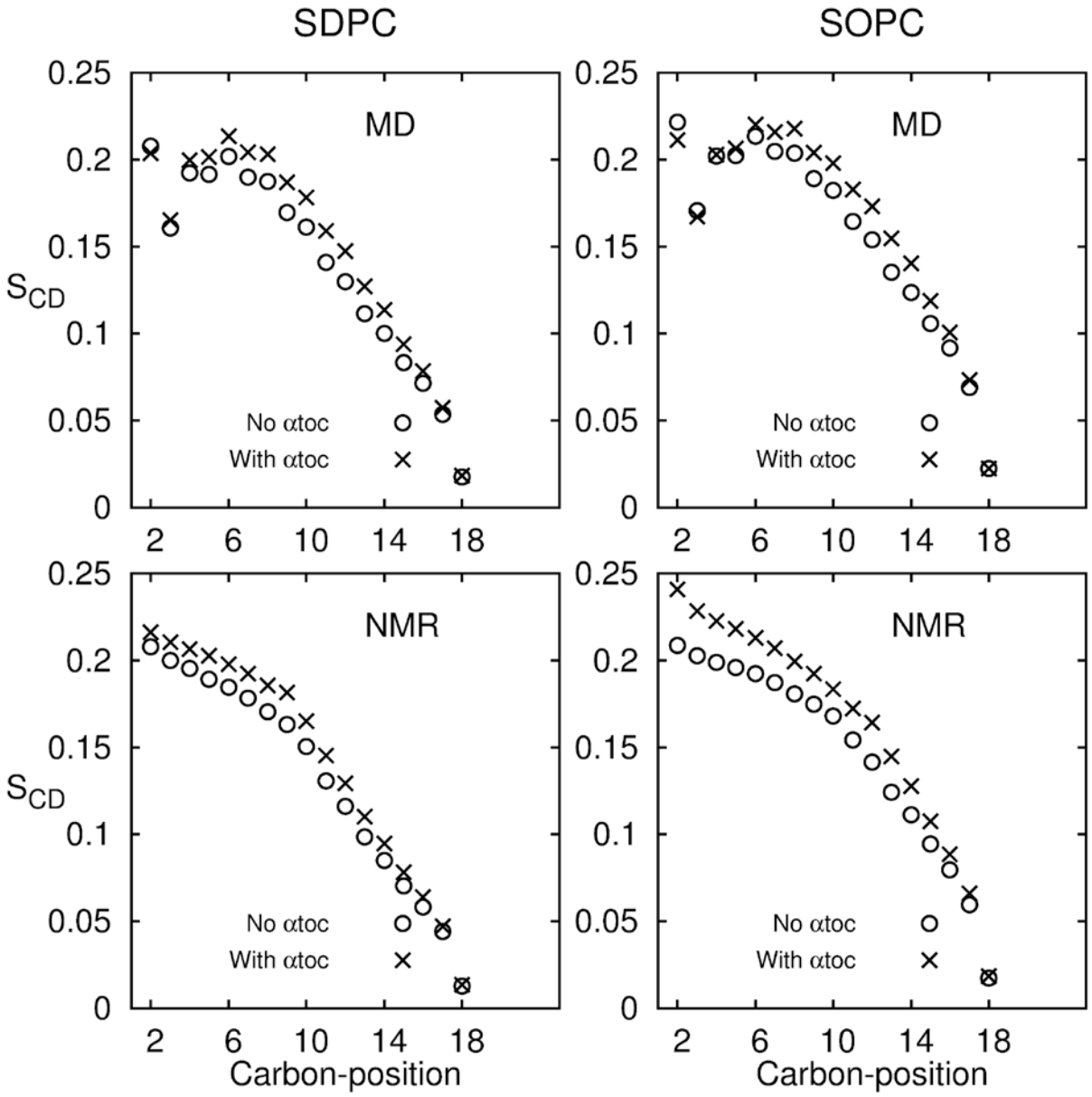

Figure S2 Order parameter profiles along the *sn*-1 chain in SDPC (left panels) and SOPC (right panels) at 37 ºC obtained in the absence (○) and presence (x) of 20 mol% αtoc from MD simulations (upper panels) and FFT depaked ^{2}H NMR spectra (lower panels).

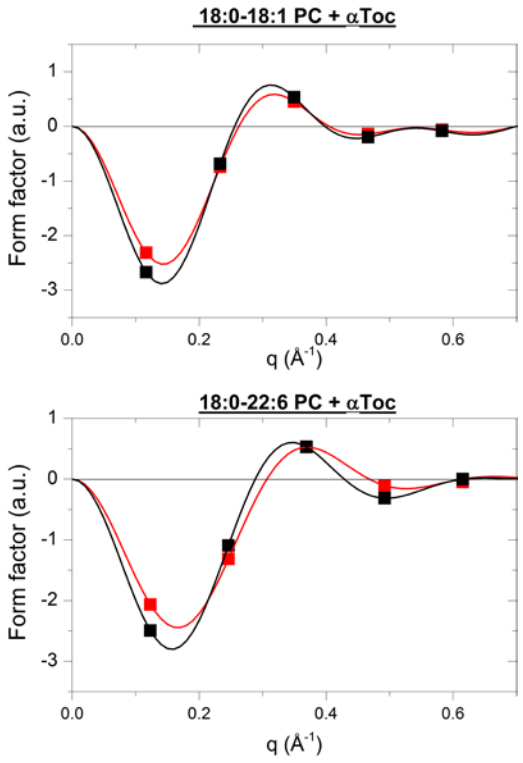

Figure S3 Measured structure factors for SOPC (18:0-18:1 PC) and SDPC (18:0-22:6 PC) membranes containing protiated αtoc (red) and C5 deuterated αtoc (black), under 94% relative humidity hydration at 37 °C. The solid squares are the measured, phased and scaled structure factors and the line is the fit of Shannon's Theorem generating a continuous form factor.

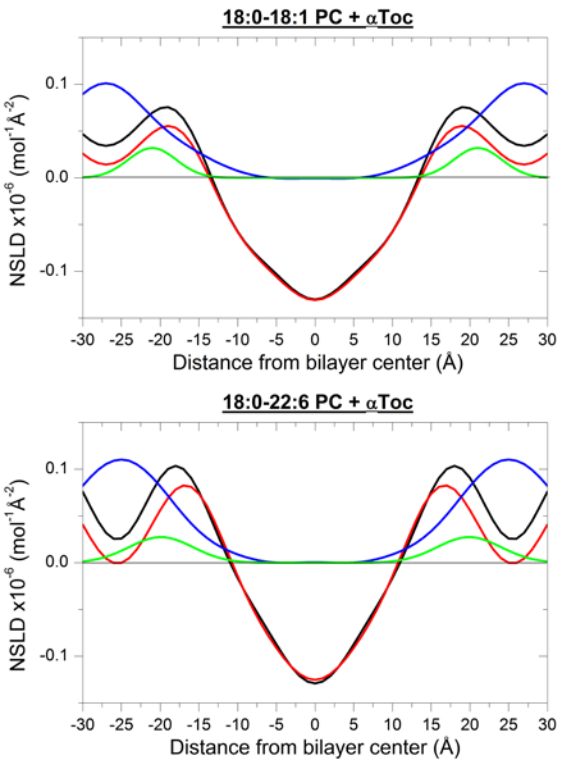

Figure S4 Scaled neutron scattering length density profiles for SOPC (18:0-18:1 PC) and SDPC (18:0-22:6 PC) with 20 mol% protiated αtoc (red) and 20 mol% αtoc-d_3 (black) hydrated with 8% D_2O at 37°C. The green line is the C5 deuterium label distribution and the blue line represents the water distribution vertically scaled down by a factor 5.

Table S2 Measured (unit cell) and calculated (other) structural parameters for α-[5-$^{2}H_3$]tocopherol (αtoc-d_3) in SOPC (18:0-18:1 PC) and SDPC (18:0-22:6 PC) membranes at 37 °C.

Phospholipid	Unit Cell	Bilayer Thickness	Water Centre*	Water Width	Label Centre*	Label Width
18:0-18:1 PC	53.8±0.3	38.8±0.2	26.9±0.1	10.6±0.5	21±1	6.2±0.3
18:0-22:6 PC	50.5±0.9	35±1.6	25.3±0.3	9.9±0.5	19±1.5	8.3±4

*Label position is relative to the bilayer center, and the range that it occupies is determined from the widths, 1/*e*, of Gaussian fits to the data. Units are angstroms (Å).

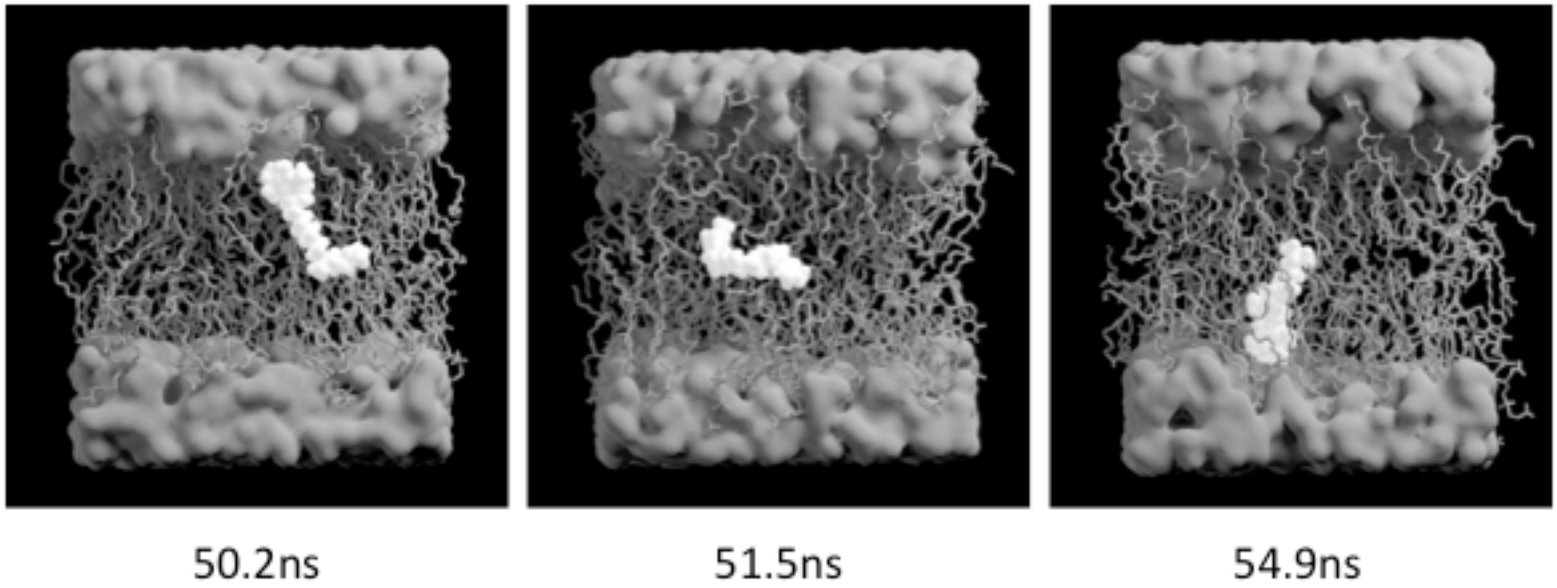

Figure S5 Enlarged versions of the snapshots presented in Figure 7.