Electronic Supporting Information

Alpha-tocopherol inhibits pore formation in oxidized bilayers

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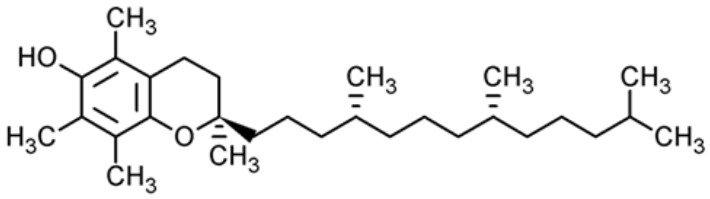
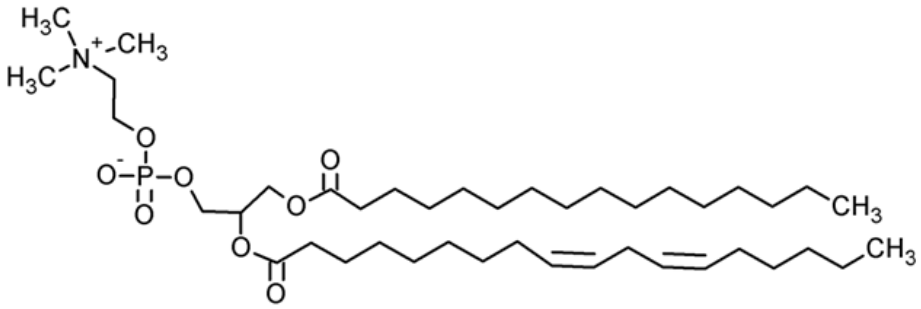
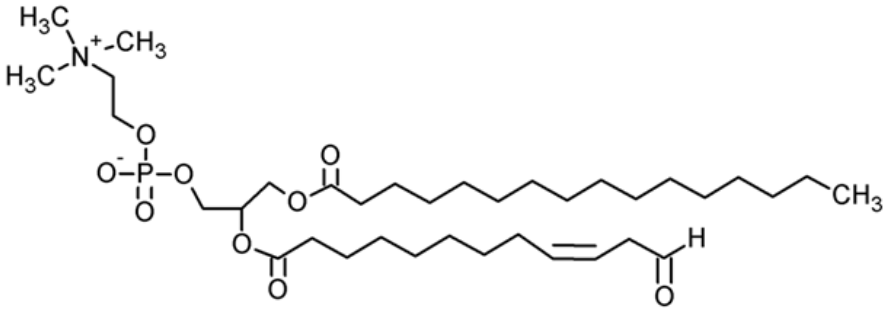


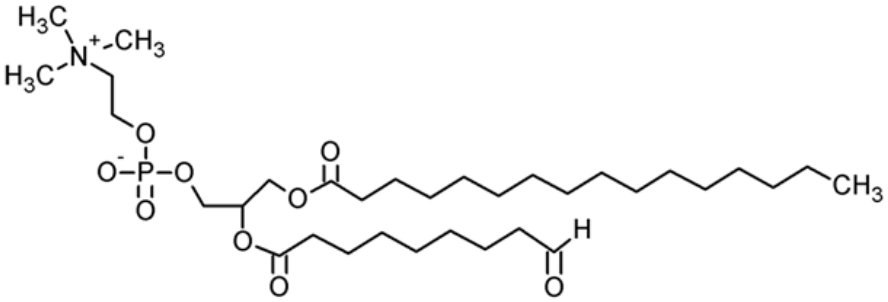
Alpha-tocopherol (α-toc)



1-palmitoyl-2-linoleoyl-*sn*-glycero-3-phosphatidylcholine (PLPC)

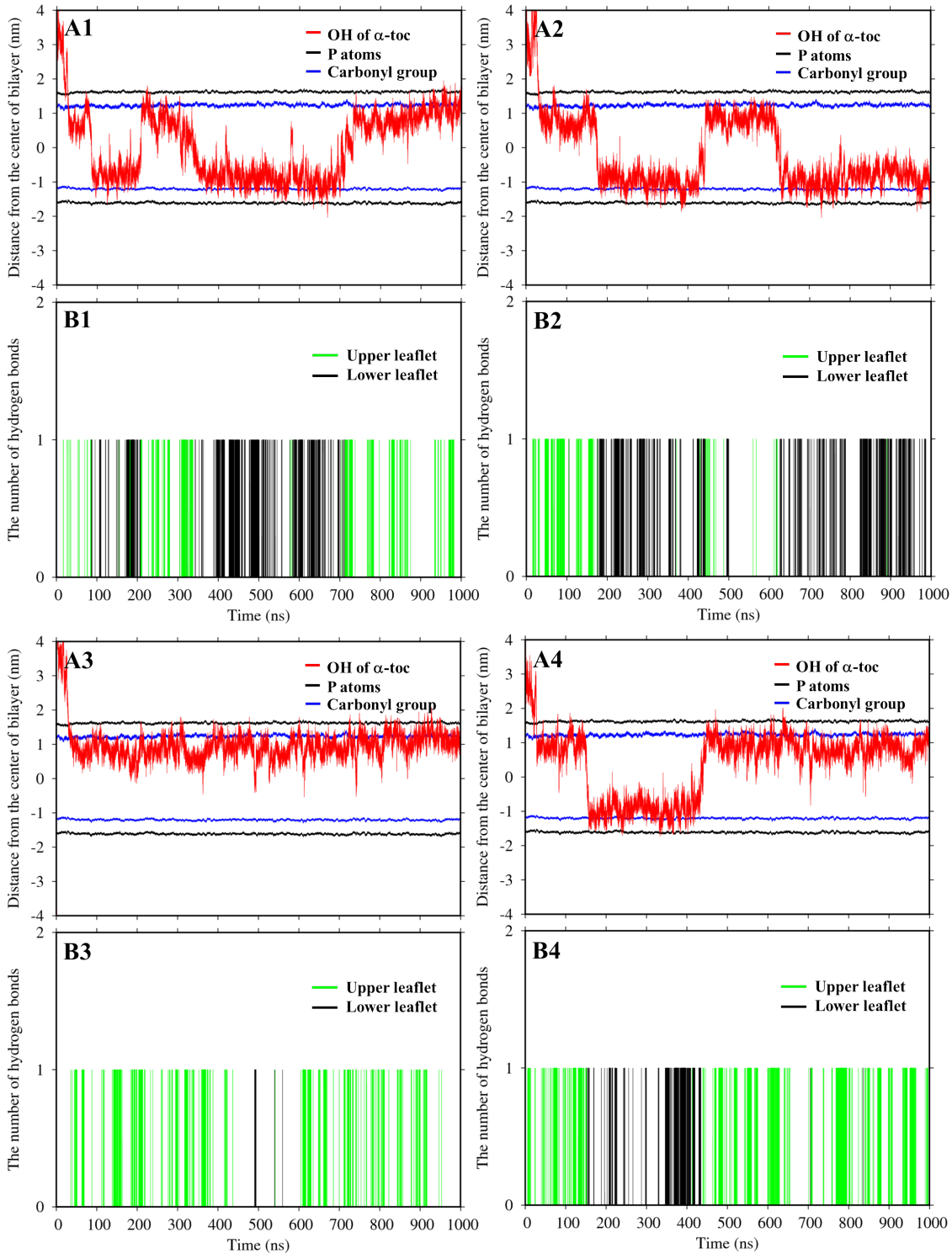


1-stearoyl-2-(12-oxo-cis-9-dodecenoyl)-*sn*-glycero-3-phosphocholine (12-al)



1-palmitoyl-2-(9-oxo-nonanoyl)-*sn*-glycero-3-phosphocholine (9-al)

Figure S1.The molecular structures of alpha-tocopherol (α-toc) and lipid molecules considered in this study.


A1
OH of α-toc
P atoms
Carbonyl group
Distance from the center of bilayer (nm)
B1
Upper leaflet
Lower leaflet
The number of hydrogen bonds
Time (ns)
A2
OH of α-toc
P atoms
Carbonyl group
Distance from the center of bilayer (nm)
B2
Upper leaflet
Lower leaflet
The number of hydrogen bonds
Time (ns)
A3
OH of α-toc
P atoms
Carbonyl group
Distance from the center of bilayer (nm)
B3
Upper leaflet
Lower leaflet
The number of hydrogen bonds
Time (ns)
A4
OH of α-toc
P atoms
Carbonyl group
Distance from the center of bilayer (nm)
B4
Upper leaflet
Lower leaflet
The number of hydrogen bonds
Time (ns)

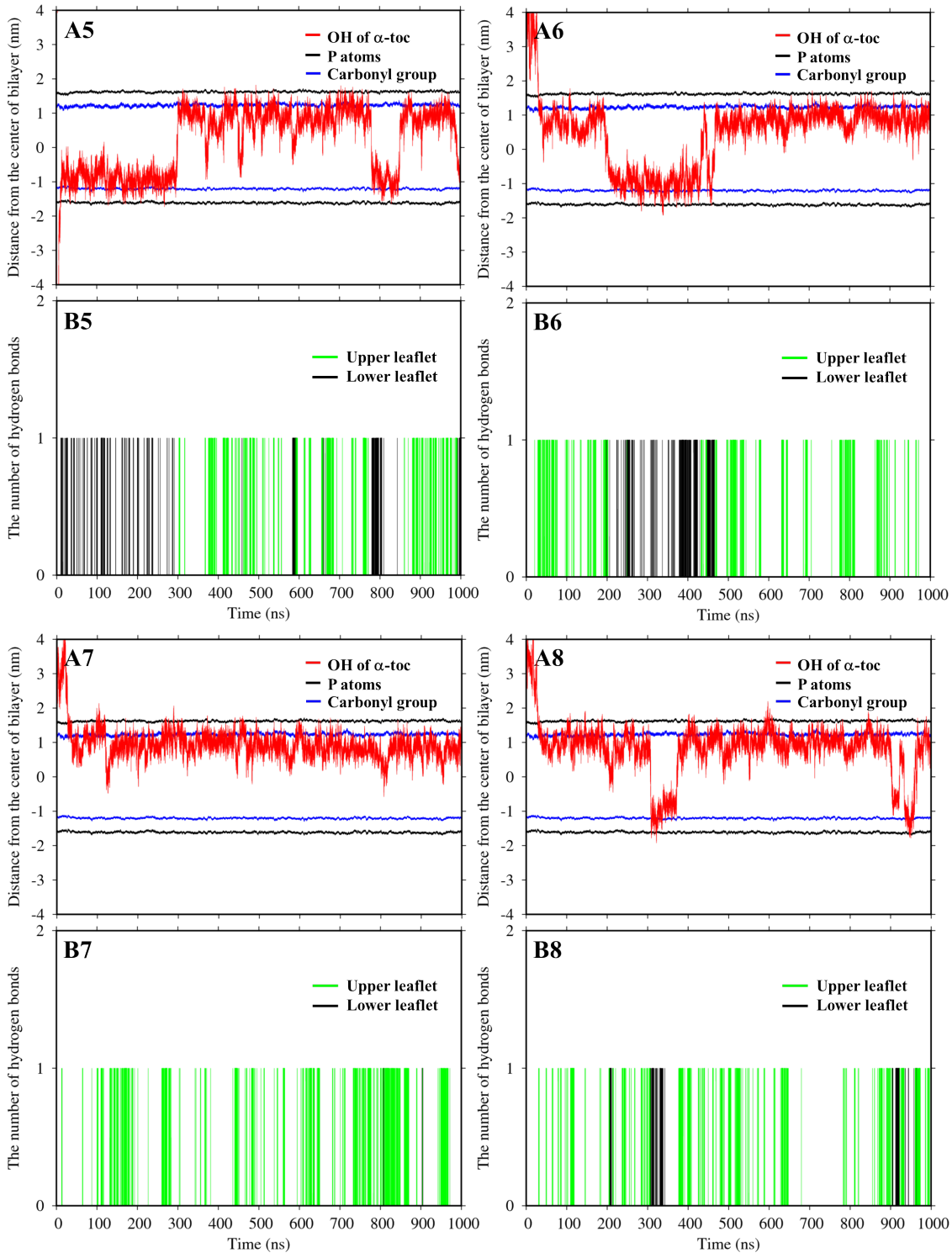


Figure S2. A1-A8: Time evolution of the hydroxyl group position for each α-toc along the z-direction measured from the center of 50% 9-al lipid bilayer with 8 α-toc molecules. B1-B8: The number of hydrogen bonds between the hydroxyl group of α-toc and the aldehyde groups of the oxidized lipid tails in the upper and lower leaflets. Hydrogen bonds were determined based on cutoffs for an angle is less than 30° and the distance is less than 0.35 nm between donor and acceptor groups.[1,2]

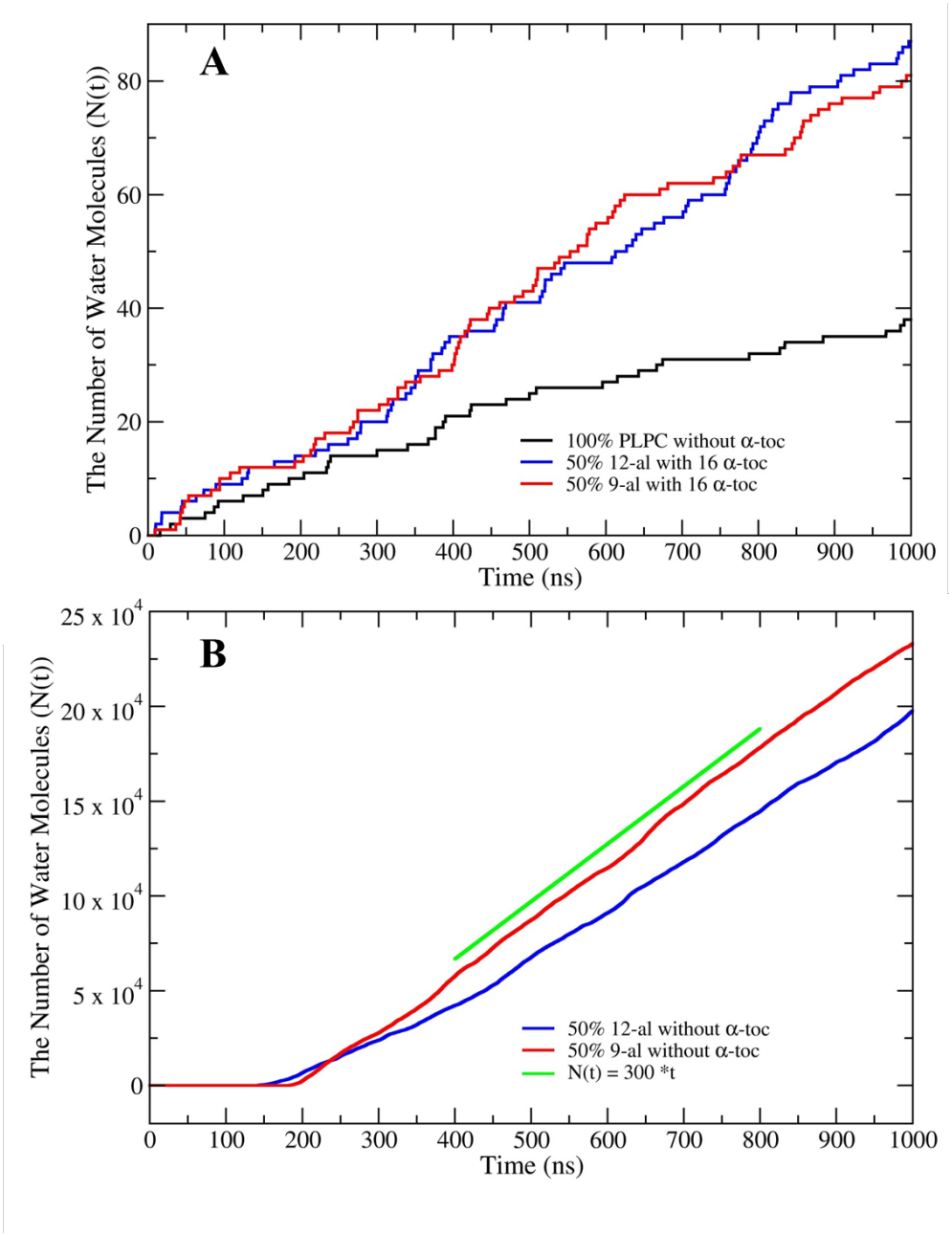


Figure S3. The number of water molecules (N(t)) permeated across the bilayer with no pore (A) and the bilayer with a pore (B). Green line: the rate of water transport across a pore in 50% 9-al system was 300 molecules/ns. Water permeability was calculated by $p_f=\nu_w R_t/NA$, where ν_w is the average volume of a single water molecule, 18 cm^3/mol, R_t is the rate of water transport across the bilayer and NA is Avogadro's number.

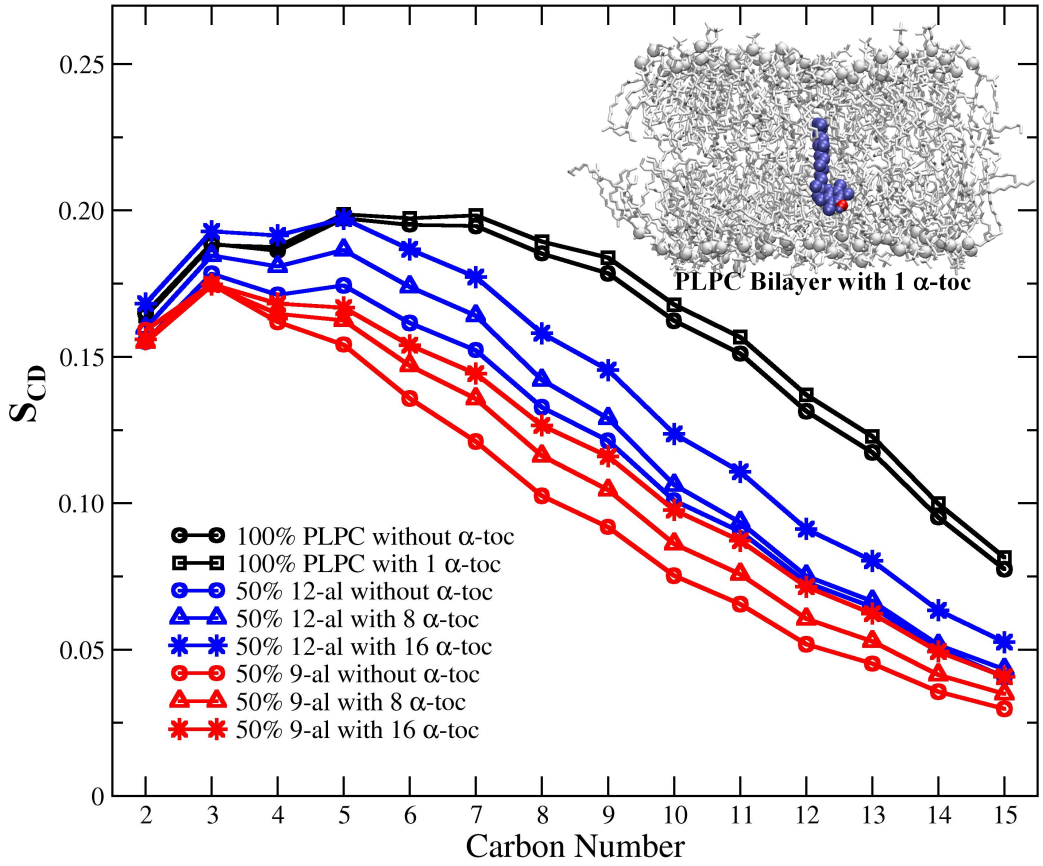


Figure S4. Deuterium order parameters (S_{CD}) for the *sn-1* chain of PLPC and oxidized lipids in the systems without and with α-toc molecules. S_{CD} were calculated at each position along the aliphatic *sn-1* chain of lipids according to[3]

$$S_{CD} = \frac{1}{2} < 3\,cos^2(\theta) - 1 >$$

where θ is the angle between a Carbon−Deuterium bond and the membrane normal (z-axis). The brackets denote averaging over all the lipids and over time. The positions of the deuterium atoms were reconstructed assuming ideal tetrahedral geometry of the methylene groups.

References

(1) Luzar, A.; Chandler, D. *Nature* **1996**, *379*, 55-57.
(2) Luzar, A.; Chandler, D. *J. Chem. Phys.* **1993**, *98*, 8160-8173.
(3) Vermeer, L. S.; de Groot, B. L.; Reat, V.; Milon, A.; Czaplicki, J. *Eur. Biophys. J.* **2007**, *36*, 919-931.