

NANOSCOPIC LIPID DOMAIN DYNAMICS REVEALED BY ATOMIC FORCE MICROSCOPY.

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Intrinsic heterogeneities are important to both the structure and function of biological membranes. We observed the effects of temperature on domain formation of a bilayer lipid mixture of dipalmitoyl phosphatidylcholine (DPPC), dilauroyl phosphatidylcholine (DLPC), and cholesterol (Chol) using an Atomic Force Microscope (AFM) with a liquid cell in an environmentally-controlled chamber. Mixtures of DPPC/DLPC/Chol at room temperature formed both microscopic and nanoscopic domains over mica substrates. At $X_{\text{dppc}} = 0.7$ and $X_{\text{chol}} = 0.189$, the nanoscopic domain size was 27 ± 0.1 nm. Both microscopic and nanoscopic domains are approximately 1.4 – 1.7 nm thicker than surrounding membrane areas. This could be due to differences in acyl chain length and/or tilt angles of the DLPC and DPPC. AFM images of an equimolar DPPC/DLPC mixture revealed 12.6 ± 0.3 nm domains. We propose that Chol may be a major factor in nanoscopic domain size. Some microscopic domains expand continuously by coalescing with nanoscopic domains as temperature increases over a range of 4 – 50 °C. Our real-time observations of membrane domain dynamics will provide a better understanding of complex membrane phase phenomena in biological systems.