

ABCA1 modifies plasma membrane organization of living cells

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The plasma membrane, composed mostly of lipids and proteins, is a dynamic structure essential for maintaining cellular homeostasis and signaling. Its composition, organization and molecular dynamics have important functional consequences for the cell, while aberrations of its integrity are associated with various human pathologies, including cancers, inflammatory and neurodegenerative diseases. ATP-binding cassette transporter A1 (ABCA1) plays a key role in cellular lipid and cholesterol metabolism, yet its impact on plasma membrane organization and dynamics remains incompletely understood. Using multidisciplinary approaches, we investigated how ABCA1 activity alters plasma membrane dynamics and nanodomain organization in living cells. Fluorescence lifetime imaging microscopy (FLIM) and fluorescence anisotropy showed that active ABCA1 increases membrane homogeneity. Proton nuclear magnetic resonance (^1H NMR) spectroscopy of living cells demonstrated that ABCA1 activity alters membrane fluidity and induces its distinct chemical composition changes. Furthermore, spot variation fluorescence correlation spectroscopy (svFCS) revealed that ABCA1 modulates lipid and protein diffusion dynamics. Our findings confirm and extend previous studies by demonstrating that ABCA1 is one of the key regulators of plasma membrane lipid distribution, influencing its structural and functional organization. By modulating lipid-raft nanodomains, ABCA1 activity may have broader implications for membrane-dependent cellular processes.

Słowa kluczowe

Plasma membrane organization, ABCA1, FLIM, NMR, svFCS

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