Abstract

After cold shock, the *Bacillus subtilis* desaturase Des introduces double bonds into the fatty acids of existing membrane phospholipids. The synthesis of Des is regulated exclusively by the two-component system DesK/DesR; DesK serves as a sensor of the state of the membrane and triggers Des synthesis after a decrease in membrane fluidity. The aim of our work is to investigate the biophysical changes in the membrane that are able to affect the DesK signalling state. Using linear alcohols (ethanol, propanol, butanol, hexanol, octanol) and benzyl alcohol, we were able to suppress Des synthesis after a temperature downshift. The changes in the biophysical properties of the membrane caused by alcohol addition were followed using membrane fluorescent probes and differential scanning calorimetry.

We found that the membrane fluidization induced by alcohols was reflected in an increased hydration at the lipid-water interface. This is associated with a decrease in DesK activity. The addition of alcohol mimics a temperature increase, which can be measured isothermically by fluorescence anisotropy. The effect of alcohols on the membrane periphery is in line with the concept of the mechanism by which two hydrophilic motifs located at opposite ends of the transmembrane region of DesK, which work as a molecular caliper, sense temperature-dependent variations in membrane properties.