A closer look at membrane fluctuations

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Biological membranes are characterized by their low bending modulus which makes them susceptible to considerable thermal fluctuations. There is increasing evidence that fluctuations, thermal or active, may have a biological significance. I shall present recent developments in experimental detection of membrane fluctuations. Artificial membranes in the form of giant unilamellar vesicles were used as test cells. Multi-wavelength reflection interference contrast microscopy was used to measure membrane fluctuations close to a substrate. It measures membrane-substrate distances with an accuracy of few nanometer and up to a range of one micrometer, with temporal resolution of about 50 ms. We also developed a novel method called position correlation spectroscopy (PCS), which is based on the set up of FCS (fluorescence correlation spectroscopy), and able to measure membrane fluctuations with spatial resolution of 20 nm and temporal resolution of 10 μs. Like FCS, PCS measures the decay of the auto-correlation in fluorescence signal, but in PCS the decay is due to membrane fluctuations rather than diffusion. The two complementary methods were used to probe the interplay of membrane adhesion and membrane fluctuations.