Abstract: Biological membranes are actively involved in several physiological processes including development and growth of organs, tissue repair and nutrient transport. To carry out their various functions, membranes adhere to other surfaces via receptor-ligand interactions, facilitate preferential transport of specific molecules across the bilayer and sometimes undergo mechanical rupture. Using in vitro experiments with either whole cells or synthetic membranes along with mathematical modeling and computer simulations we aim to elucidate membrane response to mechanical stress and chemical stimulus. We show that estimation of mechanical properties of biological membranes and the strength of their interactions with natural and synthetic surfaces are important in applications related to drug delivery and tissue engineering.

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