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Surfaces and boundaries in the mechanosensitive channel gating

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Mechanosensitive (MS) channels are gated by tension transmitted through the surrounding lipid bilayer. Inorganic ions or amphipathic modifiers that interact with the bilayer surface alter the packing of lipids and perturb the lateral pressure. We describe the effects of lanthanide ions, fluorinated alcohols and esters of parabenzoic acid as potent modifiers of MS channel gating. The other boundary that plays a critical role in channel gating is the water-vapor interface resulting from capillary dewetting of the hydrophobic gate. Molecular simulations predict two alternate positions for this boundary in the pore of the mechanosensitive channel MscS. We approached this problem experimentally by hydrophilizing the outer segment of the pore to resolve if it is 'dry' in the closed state. We observed a reduction in activating tension, substantial changes in MscS kinetics and complete removal of gating hysteresis. The kinetic treatment of channel traces recorded in response to steps of tension suggested the sequence of events that leads to the channel opening implying that pore hydration and dewetting are the rate-limiting steps in MscS transitions.