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ELECTROMECHANICAL RESPONSE OF NEURONAL CELLS

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Methods for probing mechanical responses of mammalian cells to electrical excitations can improve our understanding of cellular physiology and function. The electrical response of neuronal cells to applied voltages has been studied in detail, but less is known about their mechanical response to electrical excitations. We show that mechanical deformations of neuronal cells in response to electrical excitations can be measured using piezoelectric (PZT) nanoribbons and we find that cells deform and exert a force on the susbtrate when a voltage of several tens of millivolts is applied to the cell membrane. The measured cellular forces agree with a theoretical model in which depolarization caused by an applied voltage induces a change in membrane tension, which results in the cell altering its shape so that the pressure remains constant across the membrane. Our analysis is based on the application of the Young-Laplace law to an axisymmetric vesicle [1].

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