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# Image Analysis of a Vesicle to Calculate the Bending Modulus

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## ABSTRACT

The cell membrane is an essential component of living cells and the dynamics of the membrane will provide insight into how a biological cell reacts to mechanical strain. Membrane mechanics are important in a variety of cellular processes like secretion, trafficking, signaling, and storage. Giant unilamellar vesicles are a model system for cellular membranes since the major component of all membranes is a phospholipid bilayer. Giant unilamellar vesicles allow one to examine physicochemical processes that occur in all cellular membranes, such as fusion, budding, and fission in a more controlled fashion. Contour fluctuations of the vesicles are analyzed to calculate the bending modulus of the lipid bilayer, which will provide insight to the cell membrane's rigidity. An image processing program was developed that traces the thermal fluctuations of the vesicle membrane through edge detection. Theory of spherical harmonics was then applied to calculate the elastic properties of the bilayer based on the measured fluctuations.

## KEYWORDS

Vesicle, Bending Modulus, Image Processing, Spherical Harmonics