How biological capsules respond under stress

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Cosmetics and pharmaceutical drug delivery systems could be improved thanks to a new method developed to precisely measure the capability of capsule-like biological membranes to change shape under external stress. This work is outlined in a study about to be published in *European Physical Journal E* by Philippe Meleard and Tanja Pott from the Rennes-based Institute of Chemical Sciences at the European University of Brittany and their colleagues from the Center for Biomembrane Physics at the University of Southern Denmark in Odense.

The authors found that, by using a statistical method, they could evaluate the bending elasticity of biological membrane models, a key factor in understanding their physical properties. They relied on a series of video-microscopy images of giant liposomes, which are artificial spherical vesicles of more than ten micrometers in diameter made of a bi-layer of fatty substance called lipids. They studied the membrane deformations triggered by thermal agitation of molecules in the liquid surrounding them, over time.

Previous approaches used the average of deformation amplitudes observed in these images, which meant a loss of accuracy of up to 20 percent. Instead, in this study, the authors focused on evaluating the statistical distribution of the membrane deformation, which yielded unprecedented precision. This method relies on the so-called Maxwell-Boltzman statistical distribution, named after James Clerck Maxwell and Ludwig Boltzmann, who studied the kinetic theory of gas using this approach.

The method presented in this paper could be of interest to industry scientists in devising both cosmetic and pharmaceutical applications. For example, industry often needs to encapsulate products such as cytotoxic cancer drugs or antimicrobial peptides in biological membranes prior to delivering them into patients' bodies. Ultimately, it could help industry scientists determine what type of biological membrane is best suited for their specific purpose.

More information: Méléard P et al. (2011) Advantages of statistical analysis of giant vesicle flickering for bending elasticity measurements. *European Physical Journal E.* 34: 116 (DOI 10.1140/epje/i2011-11116-6)

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