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How to deform an egg yolk The Mechanism of Concussive Brain Injury[1] QIANHONG WU, JI LANG, Villanova University, RUNGUN NATHAN, Pennsylvania State University Berks, CELLULAR BIOMECHANICS AND SPORTS SCIENCE LABORATORY TEAM — In this study, we report a novel experimental and theoretical study to examine the response of a soft capsule bathed in a liquid environment to sudden external impacts. Taking an egg yolk as an example, a translational and a rotational impact system have been developed to investigate the deformation of the egg yolk, in which a transparent container holding both the egg yolk and egg white is used to replace the eggshell. We found that the egg yolk is not sensitive to translational impacts, but is very sensitive to rotational, especially decelerating-rotational impacts. To reveal the fundamental mechanism of the soft matter deformation observed in the experiment, a theoretical model has been developed. In our model, it shows that pressure distribution around the yolk experienced a sever change during the deceleration impact. It is the pressure distribution, the centrifugal force, and the shape of the membrane together play a critical role in causing the deformation of the soft object. The experimental and theoretical study with the egg yolk provides a new perspective for understanding the response of a membrane-bound soft object to sudden external impacts. It helps us advance the understanding of the flow physics related to the head injury.

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