

Abstract Submitted
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Bubbles of Metamorphosis¹ MANU PRAKASH, Stanford University
— Metamorphosis presents a puzzling challenge where, triggered by a signal, an organism abruptly transforms its entire shape and form. Here I describe the role of physical fluid dynamic processes during pupal metamorphosis in flies. During early stages of pupation of third instar larvae into adult flies, a physical gas bubble nucleates at a precise temporal and spatial location, as part of the normal developmental program in Diptera. Although its existence has been known for the last 100 years, the origin and control of this “cavitation” event has remained completely mysterious. Where does the driving negative pressure for bubble nucleation come from? How is the location of the bubble nucleation site encoded in the pupae? How do molecular processes control such a physical event? What is the role of this bubble during development? Via developing in-vivo imaging techniques, direct bio-physical measurements in live insect pupal structures and physical modeling, here I elucidate the physical mechanism for appearance and disappearance of this bubble and predict the site of nucleation and its exact timing. This new physical insight into the process of metamorphosis also allows us to understand the inherent design of pupal shell architectures in various species of insects.

¹Milton Award, Harvard Society of Fellows; Terman Fellowship, Stanford

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