JOHNS HOPKINS
Center for Environmental & Applied Fluid Mechanics

FALL 2021 CEAFM VIRTUAL SEMINAR SERIES

"Drinking and Diving"

Presented by Prof. Sunghwan (Sunny) Jung

Cornell University
Department of Biological and Environmental Engineering
Hosted by Chen Li (MechE)

Fluids are vital to all life forms, and organisms have presumably adapted their behaviors or features in response to mechanical forces to achieve better performance. In this talk, I will discuss two biological problems in which animals exploit mechanics principles. First, we investigated how animals transport water into the mouth using an inertia-driven (lapping) mechanism. Dogs accelerate the tongue upward (up to 4 g) to create a larger water column while drinking, whereas cats use a tongue motion with relatively small acceleration. We found that, to maximize the water intake per lap, both cats and dogs close the jaw at the column break-up time governed by unsteady inertia. This break-up (or pinch-off) time can be predicted using the stability analysis of the water column in which surface tension balances with inertia. Second, we studied how birds with long slender necks plunge-dive and survive from the impact. Physical experiments using an elastic beam as a model for the neck attached to a skull-like cone revealed limits for the stability of the neck during plunge-dive. This neck response can be simplified as the Euler beam buckling problem with unsteady impact force on the head. We found that the small angle of the bird's beak and the strong muscles in the neck predominantly reduce the likelihood of injury during high-speed plunge-dive. In addition, I will talk about various diving postures in human diving in terms of the force acting on the body.

Friday, September 17, 2021 at 3:00 PM EDT

https://wse.zoom.us/j/93762992307