Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Undulatory swimming of a sandfish lizard in granular media[1]

DANIEL GOLDMAN, RYAN MALADEN, CHEN LI, YANG DING, Georgia Tech

— We study the locomotion of the desert dwelling sandfish lizard (*Scincus scincus*) as it dives into and swims beneath the surface of sand ($300\mu m$ glass beads). Above the surface, the animal uses a diagonal gait to move rapidly across the sand. High speed x-ray imaging reveals that once subsurface the animal no longer uses limbs for propulsion but instead folds the limbs against the body and generates thrust using a large amplitude undulatory motion consisting of a traveling wave with frequency f that propagates down the body with one wave period. The forward swimming speed v (maximum 10 cm/sec) increases with increasing f. We measure v versus f as a function of packing fraction of the material ϕ. To predict v as a function of f and ϕ, we model the animal as a series of elements, each which produces thrust and experiences drag along its surface. We measure thrust and drag coefficients by performing drag measurements on a small stainless steel rod (grain-rod friction comparable to the animal's skin) as a function of rod angle, rod speed, and ϕ. Integrating the drag law over a sinusoidal wave form accurately predicts the $v - f$ relationship of the animal in loose and close packed granular media.

[1]work supported by the NSF Physics of Living Systems

Daniel Goldman
Georgia Tech

Date submitted: 29 Dec 2008 Electronic form version 1.4