High speed x-ray observation of a sand swimming lizard\textsuperscript{1} DANIEL GOLDMAN, School of Physics, Georgia Tech, RYAN MALADEN, Bioengineering Program, Georgia Tech, YANG DING, School of Physics, Georgia Tech — We use high-speed x-ray imaging to reveal how a small (10 cm) desert dwelling lizard, the sandfish (\textit{Scincus scincus}), swims within a granular medium, and how its locomotion is affected by the volume fraction \( \phi \) of the media \textsuperscript{2}. We use an air fluidized bed to prepare 0.3 mm glass beads (similar in size to desert sand) into naturally occurring loose (\( \phi = 0.58 \)) and close (\( \phi = 0.62 \)) packed states. On the surface, the lizard uses a standard diagonal gait, but once below the surface, the organism no longer uses limbs for propulsion. Instead it propagates a large amplitude single period sinusoidal traveling wave down its body and tail to propel itself at speeds up to \( \approx 1 \) body-length/sec. For fixed \( \phi \) the animal increases forward swimming speed \( v_f \) by increasing temporal frequency \( f \). For fixed \( f \), \( v_f \) is independent of \( \phi \), despite resistance forces that nearly double from loose to close packed states. Surprisingly, the greatest sandfish velocity (and \( f \)) occur in the close packed state.

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\textsuperscript{2}Maladen et. al, Science, \textbf{325}, 314, 2009

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