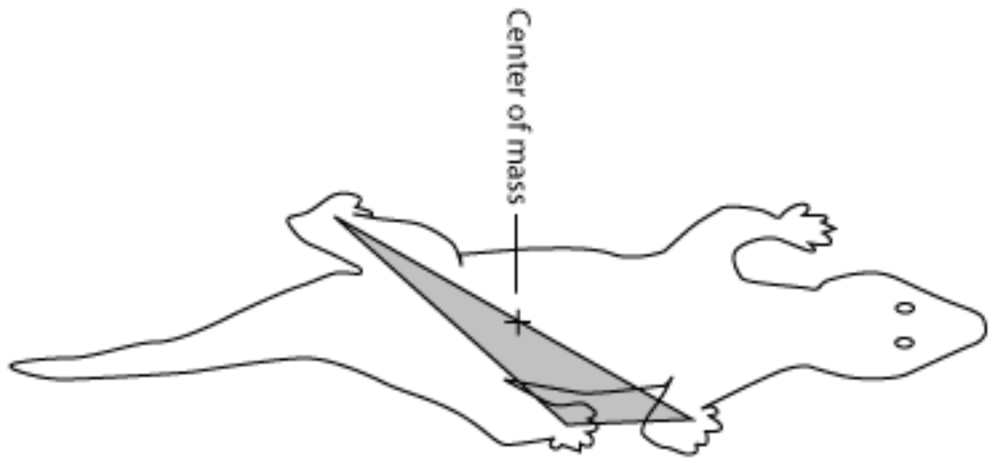
Locomotion

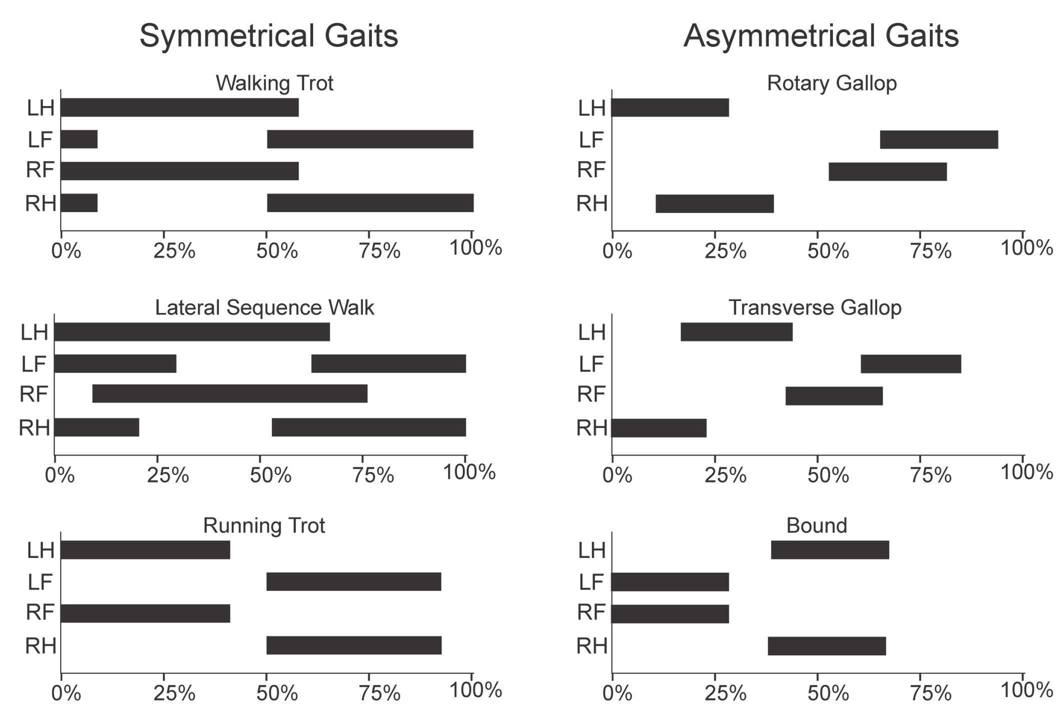
- Crawling/running
- Limbless
- Jumping
- Burrowing
- Climbing
- Aquatic
- Gliding

Terrestrial locomotion

Center of mass



Gait

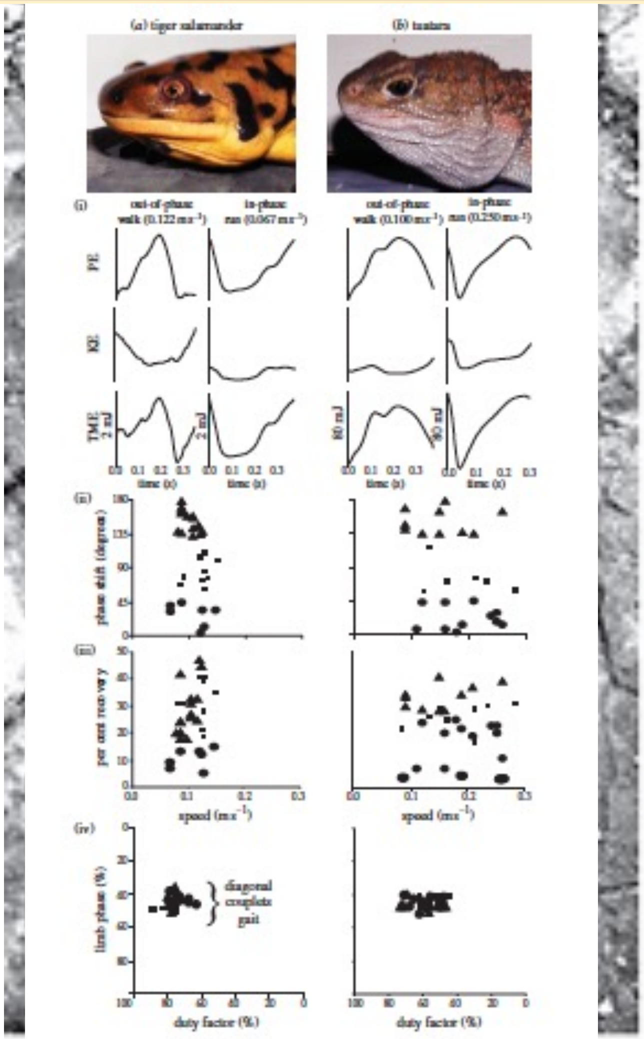


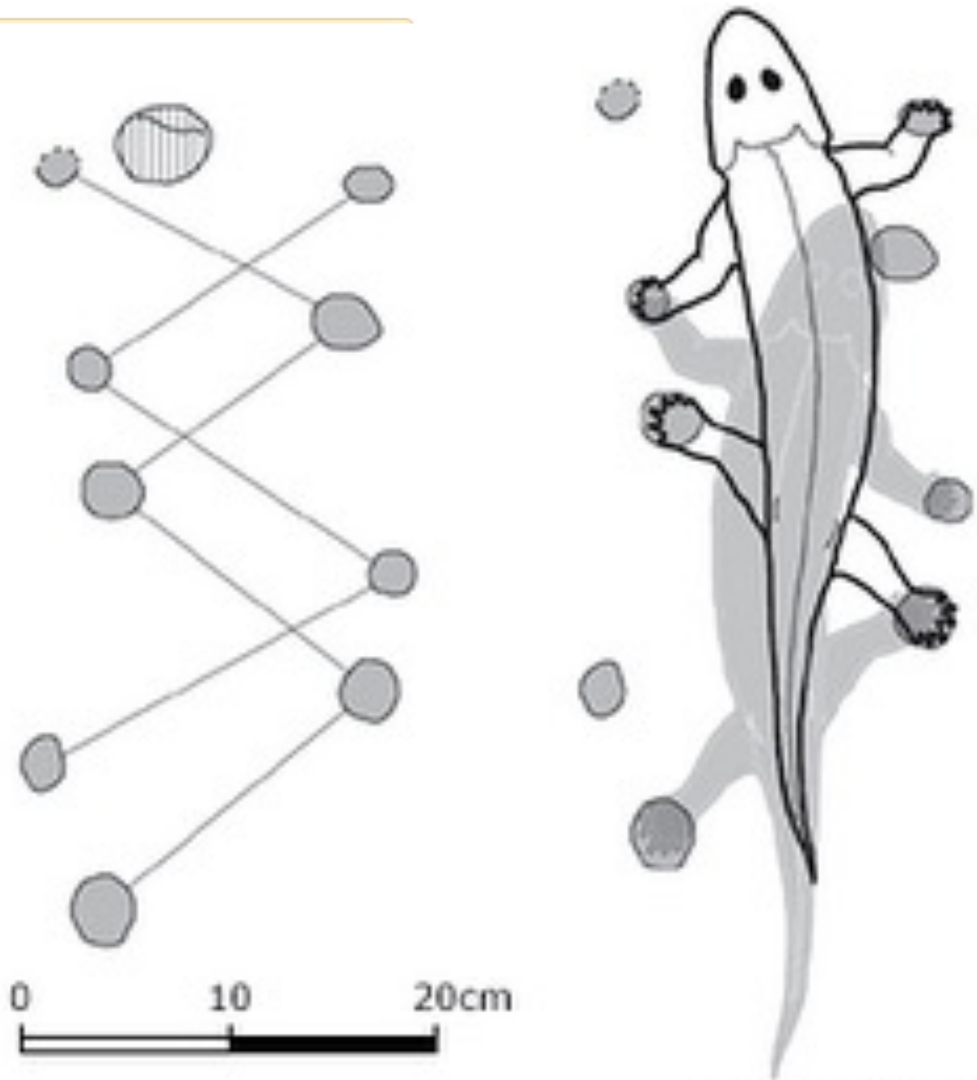
Proc Biol Sci. 2006 Jun 22; 273(1593): 1563–1568.
Published online 2006 Mar 7. doi: 10.1098/rspb.2006.3489

PMCID: PMC1560307

Tuataras and salamanders show that walking and running mechanics are ancient features of tetrapod locomotion

Stephen M Reilly,[1,*] Eric J McElroy,[1] R Andrew Odum,[2] and Valerie A Hornyak[2]

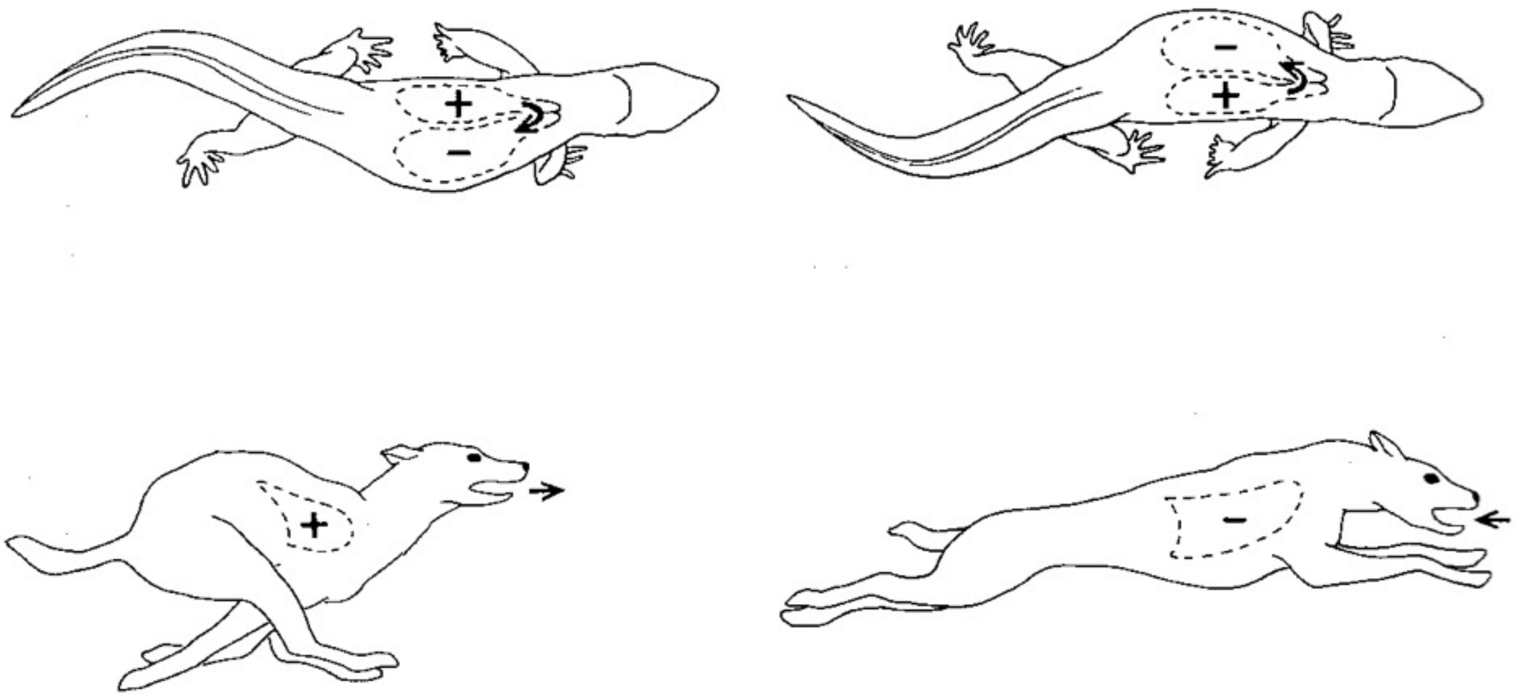




Paleobiology, 13(3), 1987, pp. 326–341

The evolution of locomotor stamina in tetrapods: circumventing a mechanical constraint

David R. Carrier

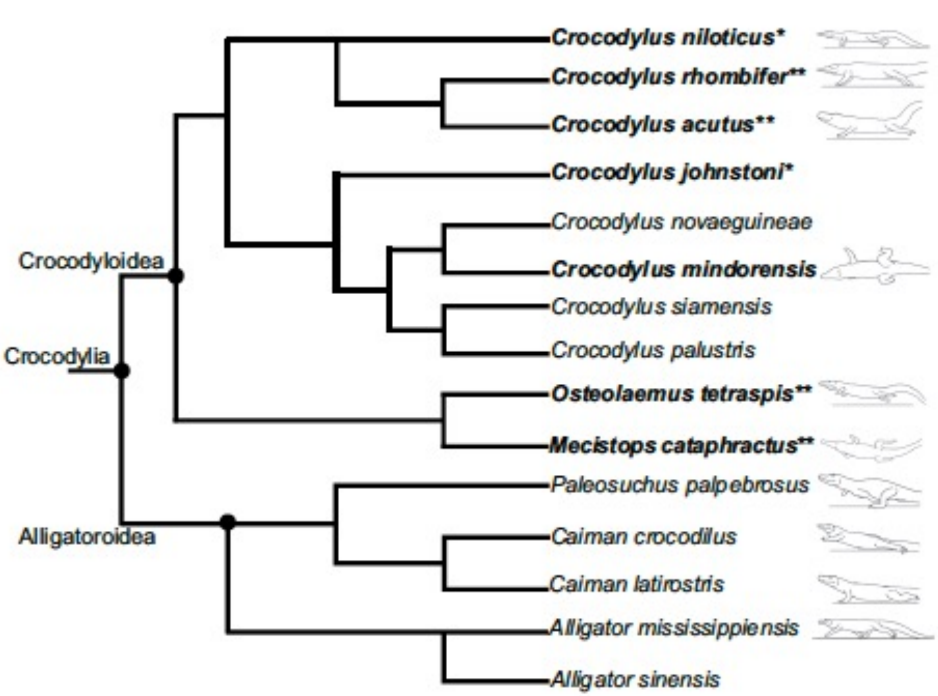


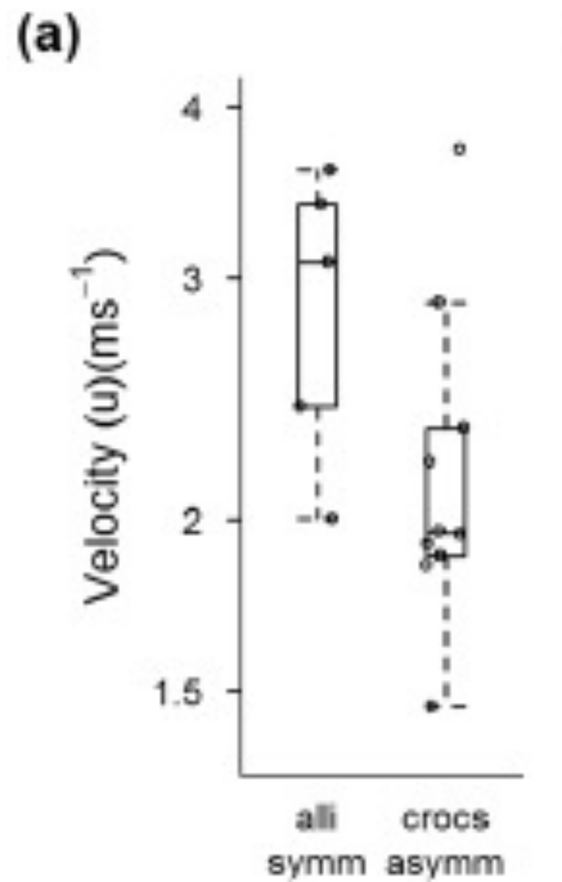
The reptilian
idea of fun
Is to bask all day
in the sun.
A physiological
barrier,
Discovered by
Carrier,
Says they can't
breathe, if they
run.
R. Cowen

SCIENTIFIC REPORTS
natureresearch

Divergent evolution of terrestrial locomotor abilities in extant Crocodylia

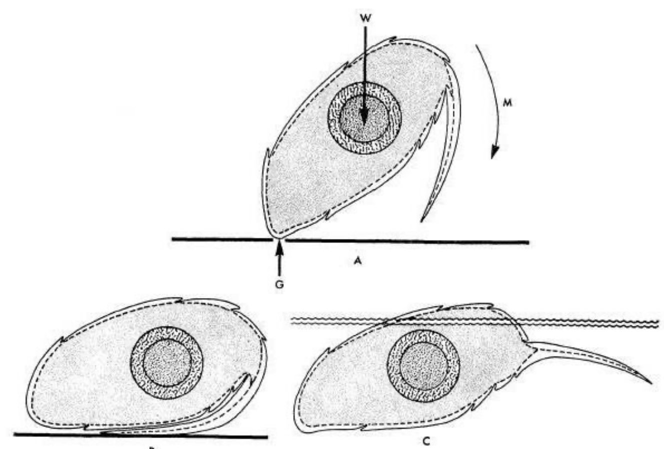
John R. Hutchinson[1*], Dean Felkler[1], Kati Houston[2], Yu-Mei Chang[3], John Brueggen[2], David Kledzik[2] & Kent A. Vliet[2,4]



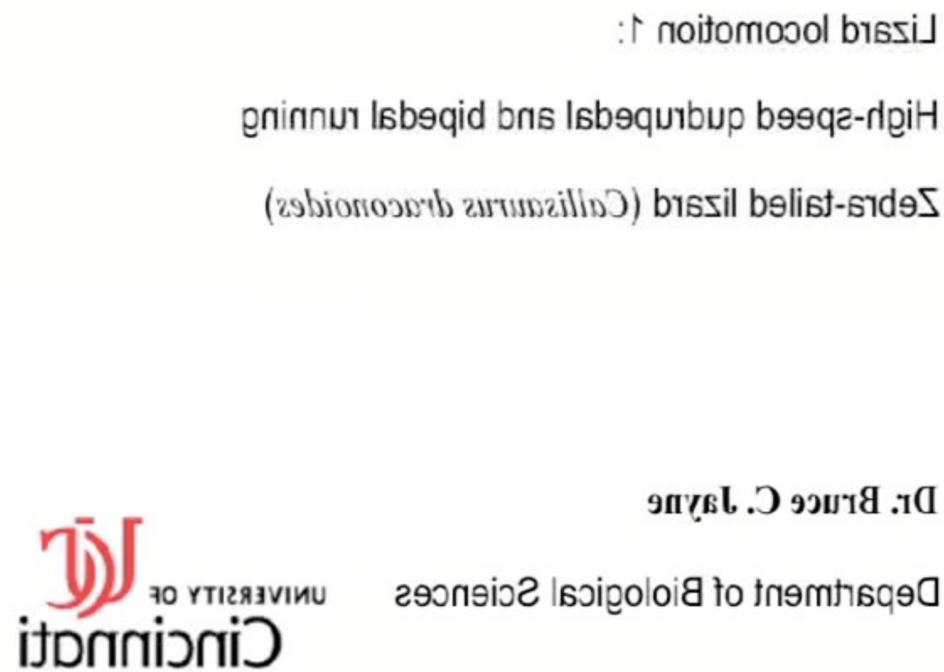


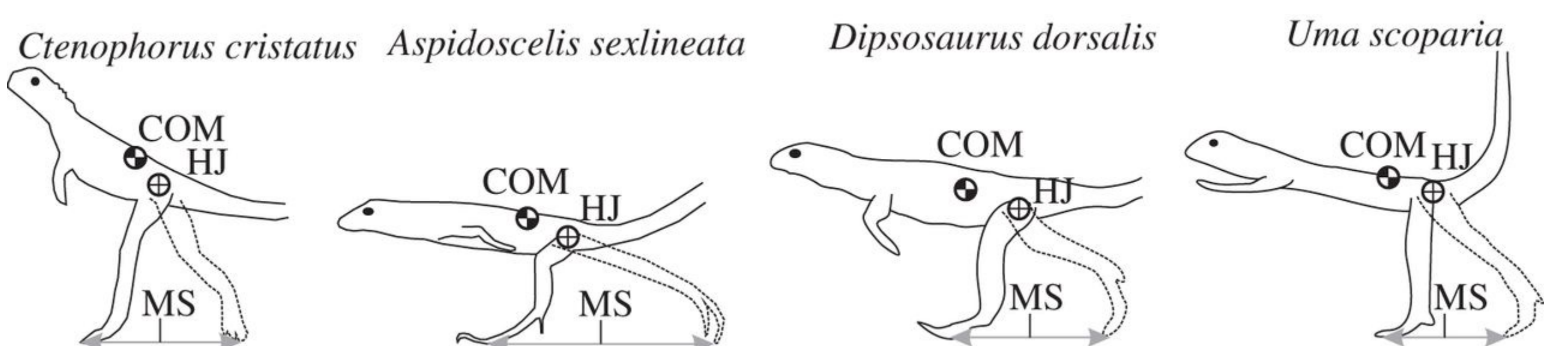
Quadrupedal→ bipedal

- Dynamic bipeds
- Anatomy
  - Longer hindlimbs, longer feet
  - Few presacral vertebrae
  - Long tail
- Sand, water running

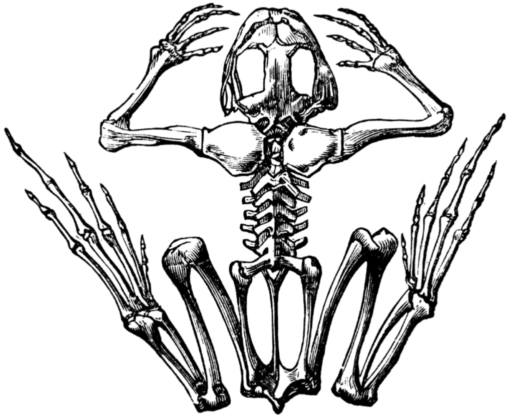


Quadrupedal→ bipedal





Saltation



- Short, rigid vertebral column
- Elongate hindlimbs, feet

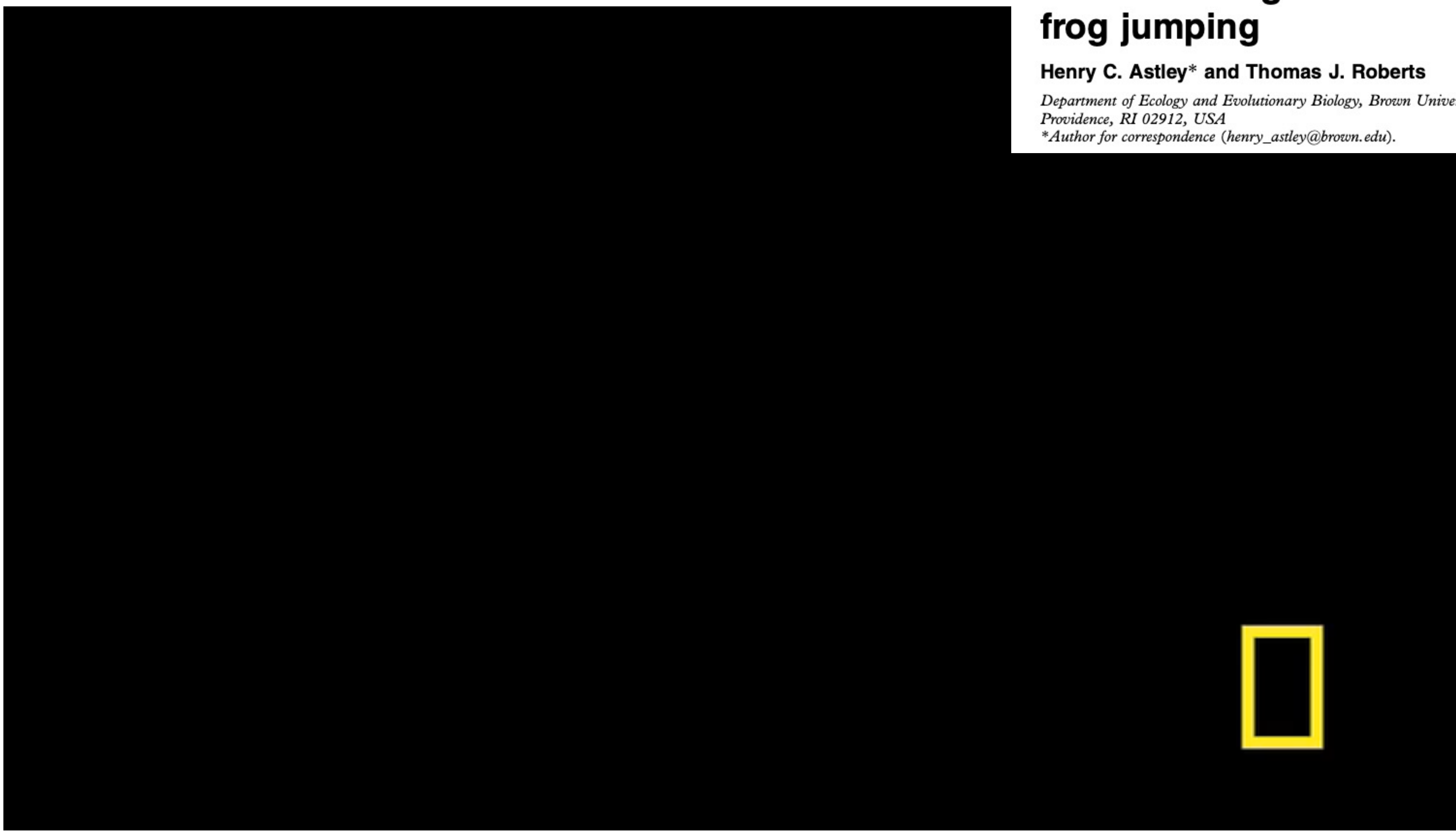
Saltation

biology letters
Biol. Lett. (2012) 8, 386–389
doi:10.1098/rsbl.2011.0982
Published online 16 November 2011
Biomechanics

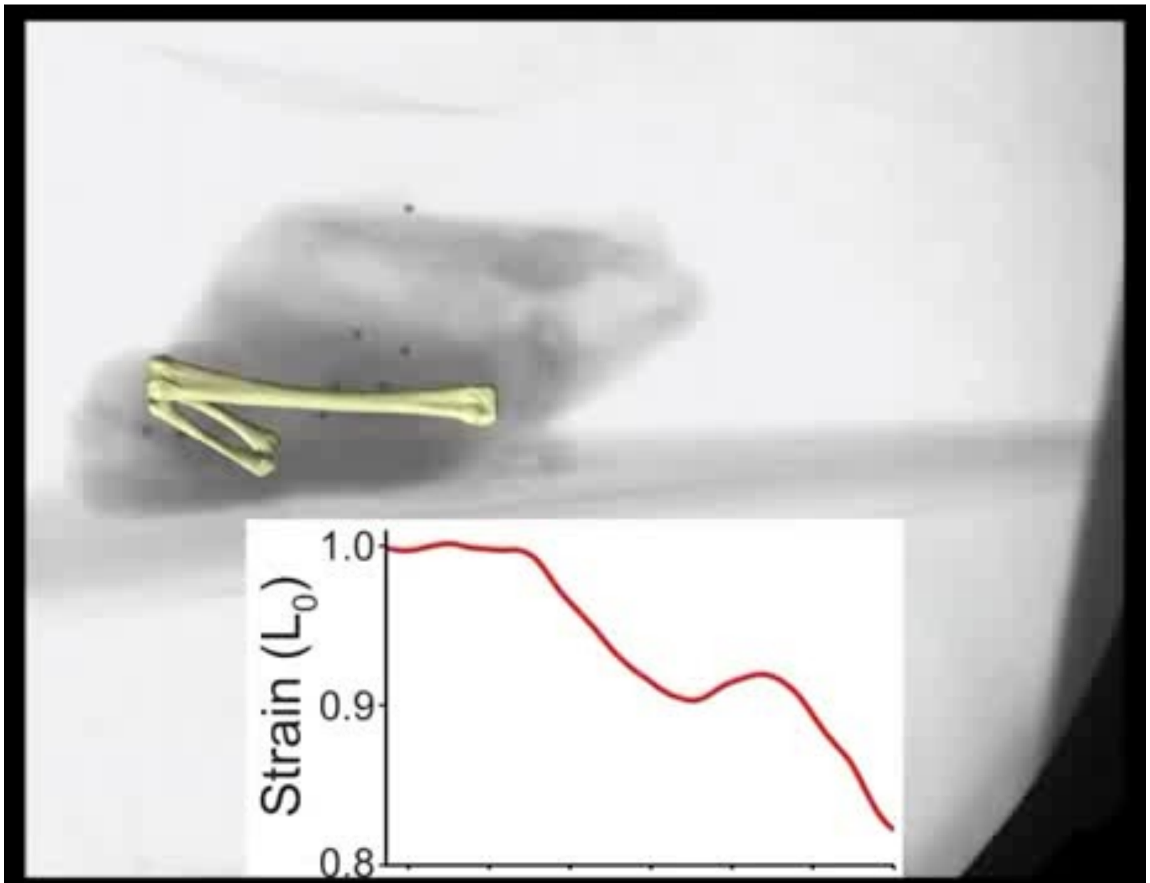
Evidence for a vertebrate catapult: elastic energy storage in the plantaris tendon during frog jumping

Henry C. Astley* and Thomas J. Roberts

Department of Ecology and Evolutionary Biology, Brown University, Providence, RI 02912, USA
**Author for correspondence (henry_astley@brown.edu).*



Saltation



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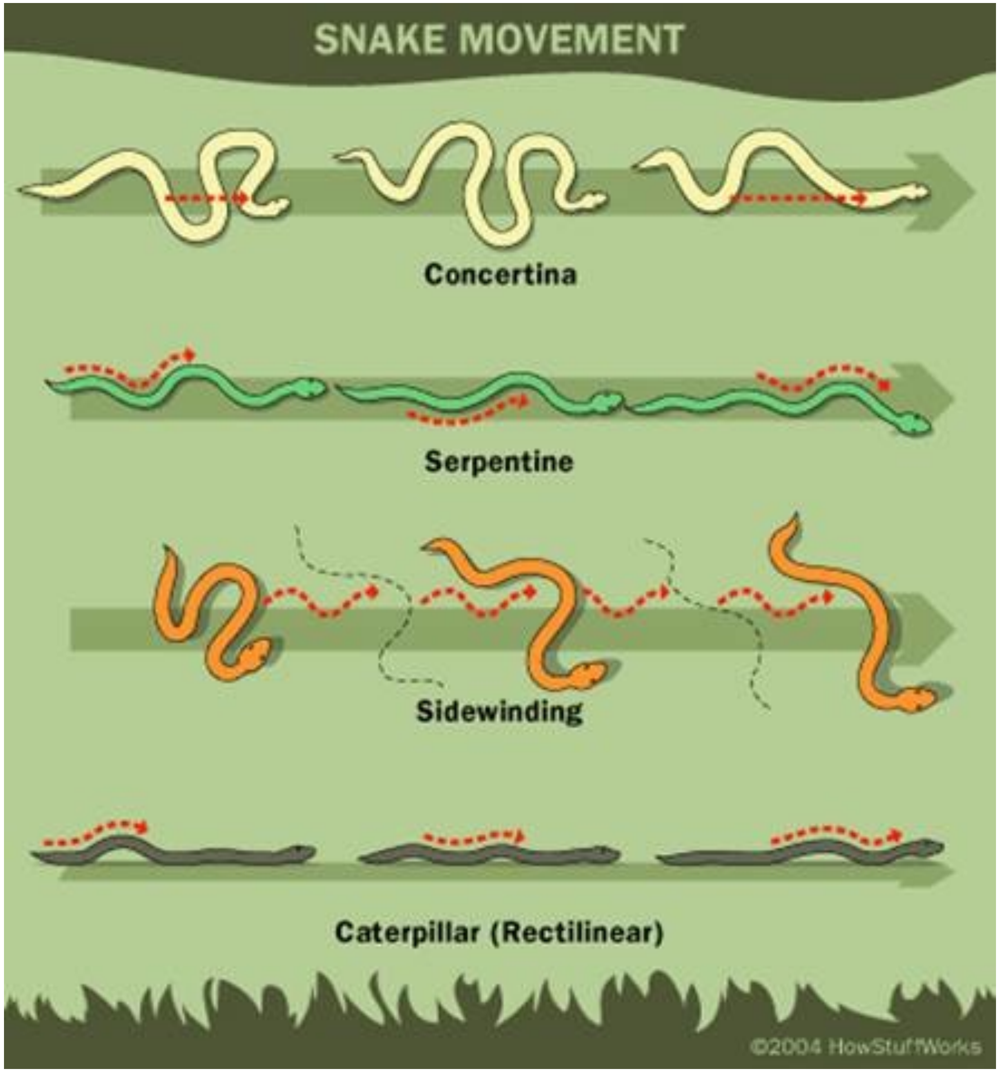
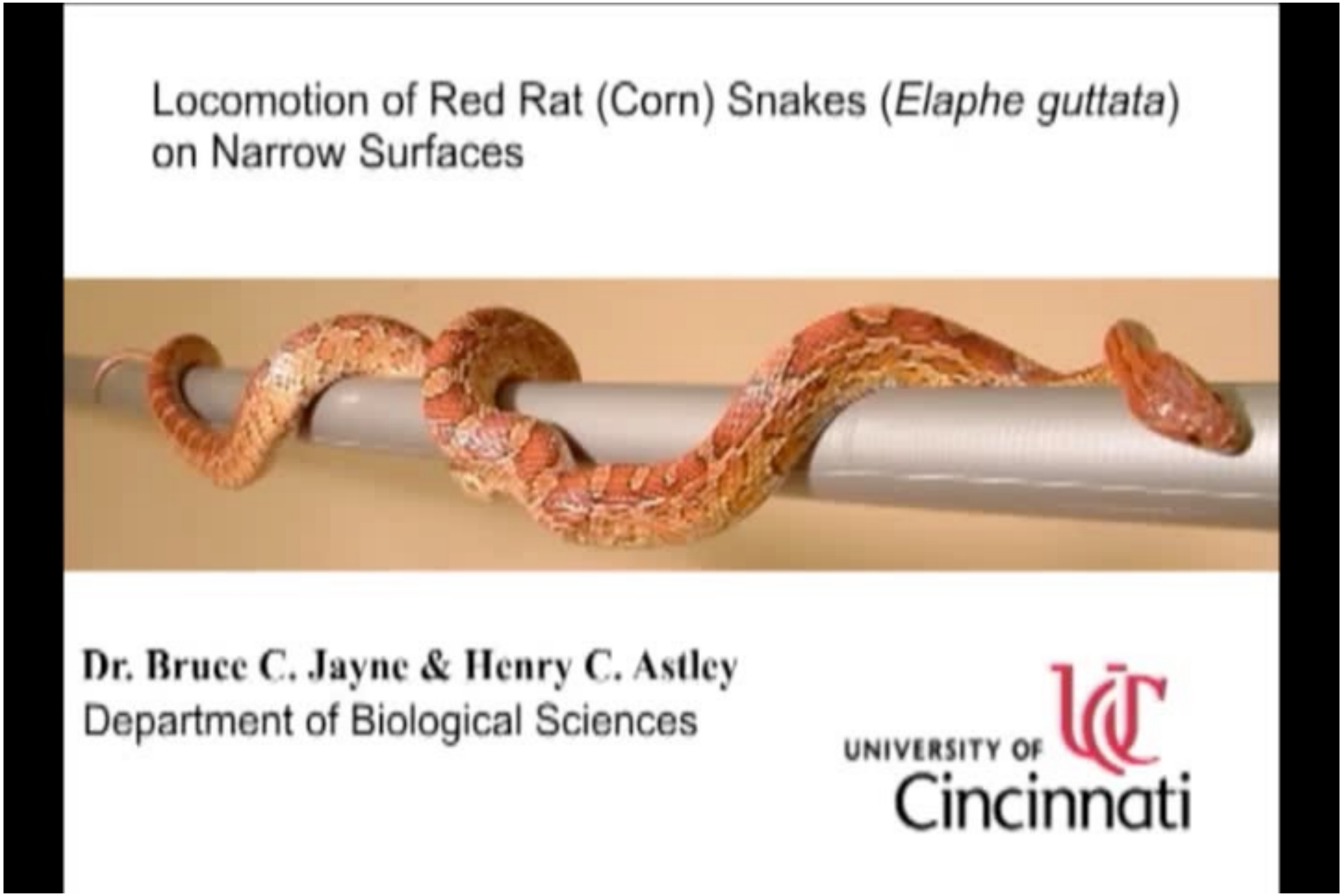
**Author for correspondence (henry_astley@brown.edu).*

Limbless locomotion



Limbless locomotion



Limbless locomotion

Brown tree snake (*Boiga irregularis*) moving across gaps

Dr. Bruce C. Jayne
Department of Biological Sciences

UNIVERSITY OF Cincinnati

Limbless locomotion

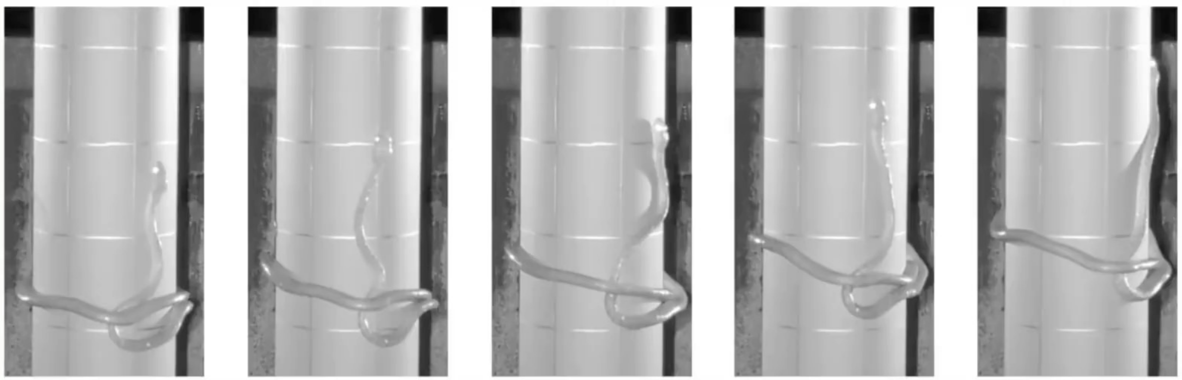
Hamidreza Marvi[1], Chaohui Gong[2], Nick Gravish[1],
Henry Astley[1], Matt Travers[2], Ross Hatton[3], Joe Mendelson[1,4],
Howie Choset[2], David Hu[1], and Daniel Goldman[1]

Georgia Institute of Technology[1],
Carnegie Mellon University[2],
Oregon State University[3],
Zoo Atlanta[4]

Limbless locomotion

Lasso locomotion expands the climbing repertoire of snakes

Current Biology



J.A. Savidge, T.F. Seibert, M. Kastner & B.C. Jayne

COLORADO STATE UNIVERSITY

UNIVERSITY OF Cincinnati

Current Biology
Magazine

Correspondence

Lasso locomotion expands the climbing repertoire of snakes

Julie A. Savidge[1,3,*], Thomas F. Seibert[1,3], Martin Kastner[1], and Bruce C. Jayne[2,3,*]

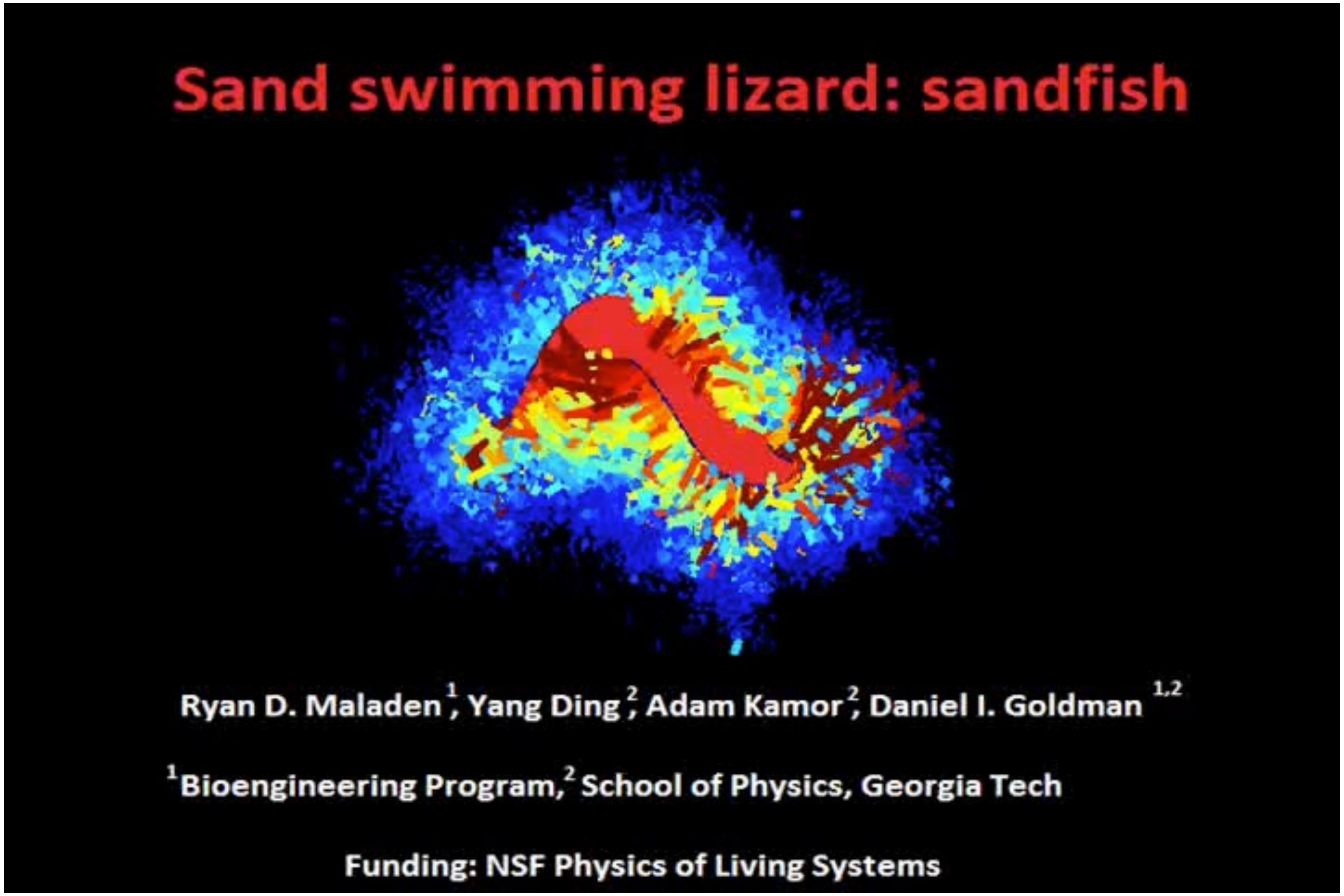
Burrowing

- Anatomical traits
  - Ossified, fused skull
  - Compressed/pointed skull
  - Smooth skin/reduced # scales
  - Limbs reduced/absent
- Scratch digging
- Hindlimbs digging
- Limbless
  - Concertina
  - Internal concertina
- Sand swimming

Fig. 1. Internal concertina locomotion

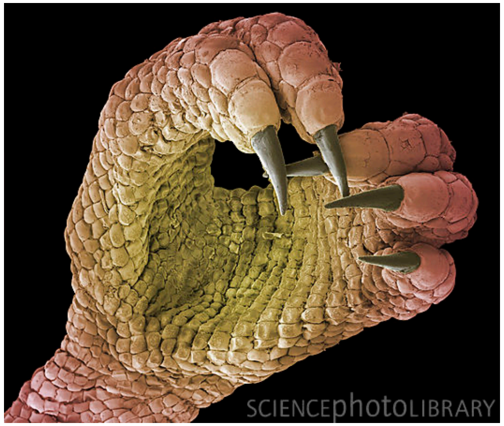
Burrowing

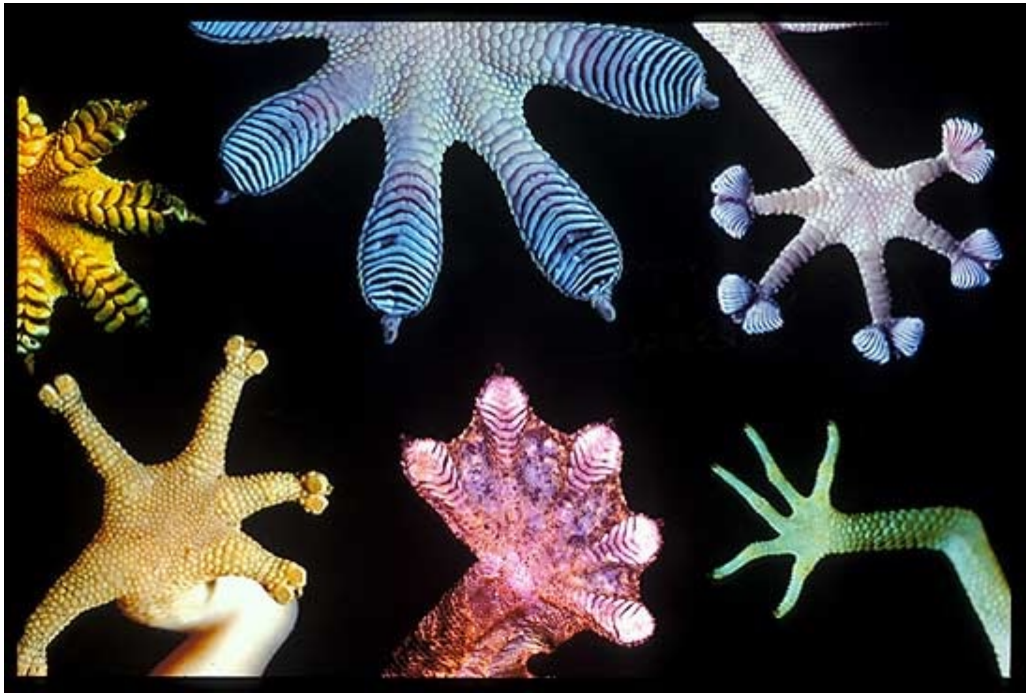
Burrowing


Sand swimming lizard: sandfish
Ryan D. Maladen[1], Yang Ding[2], Adam Kamor[2], Daniel I. Goldman[1,2]
[1]Bioengineering Program,[2] School of Physics, Georgia Tech
Funding: NSF Physics of Living Systems

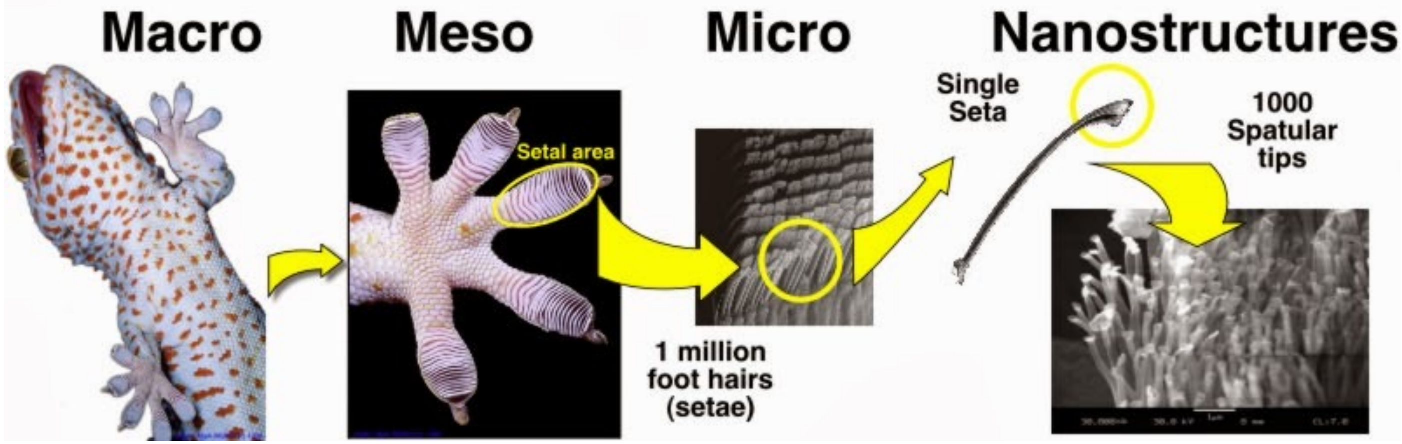
Climbing

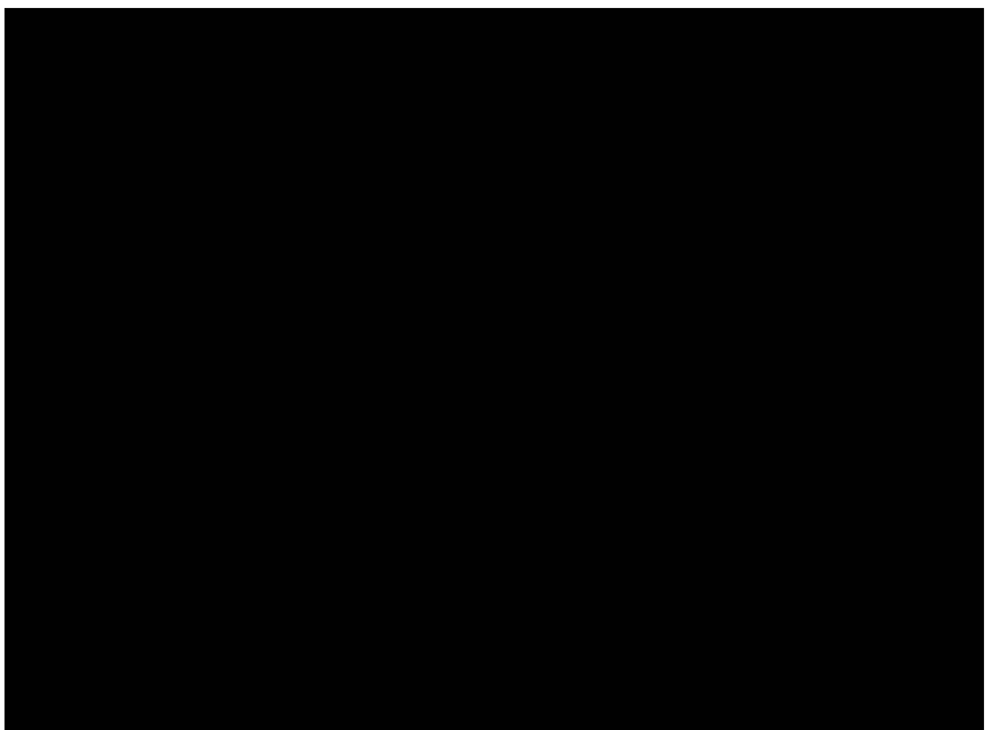
- Amphibians
  - Capillary adhesion
  - Suction
- Reptiles
  - Claws
  - Grasping
  - Scansors
    - VDW forces
  - Limbless
    - Concertina
    - Serpentine

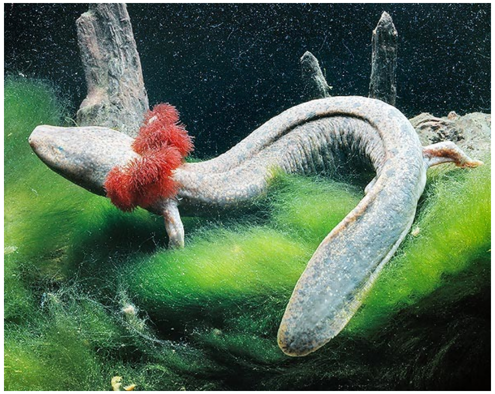




Gecko adhesive system



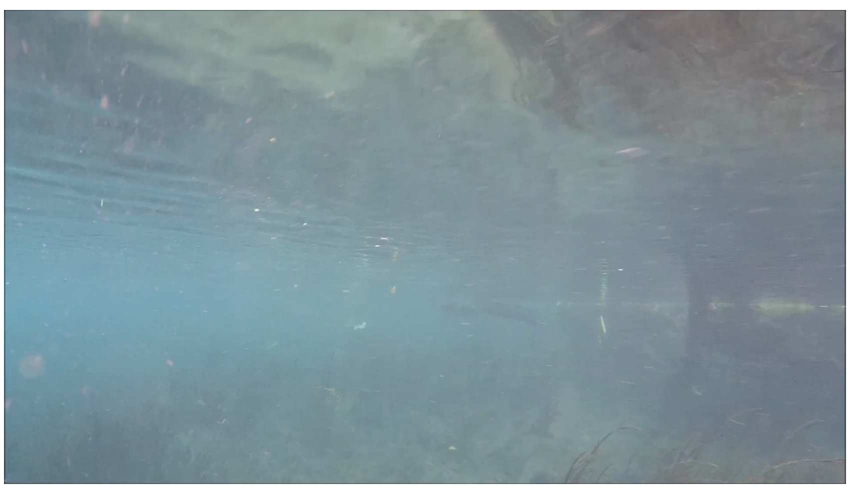




Aquatic

- Anatomy
  - Fins, webbing
  - Elongate, streamlined body
- Undulatory
  - Most herps
- Oscillatory
  - Frogs, turtles

Aquatic



Gliding

- Parachuting, gliding
- Anatomy
  - Skin flaps
  - Webbing
  - Ribs
- *Rhacophorus, Ptychozoon, Draco, Chrysopelea*

Gliding

Gliding

Gliding