Salamander Foot Design

Midterm semester project presentation

Laura Paez

Outline

- Motivation
- Previous work
- Purpose
- Design methodology (Niches in Taxonomy)
- Hardware design concept
- Future work
- Questions

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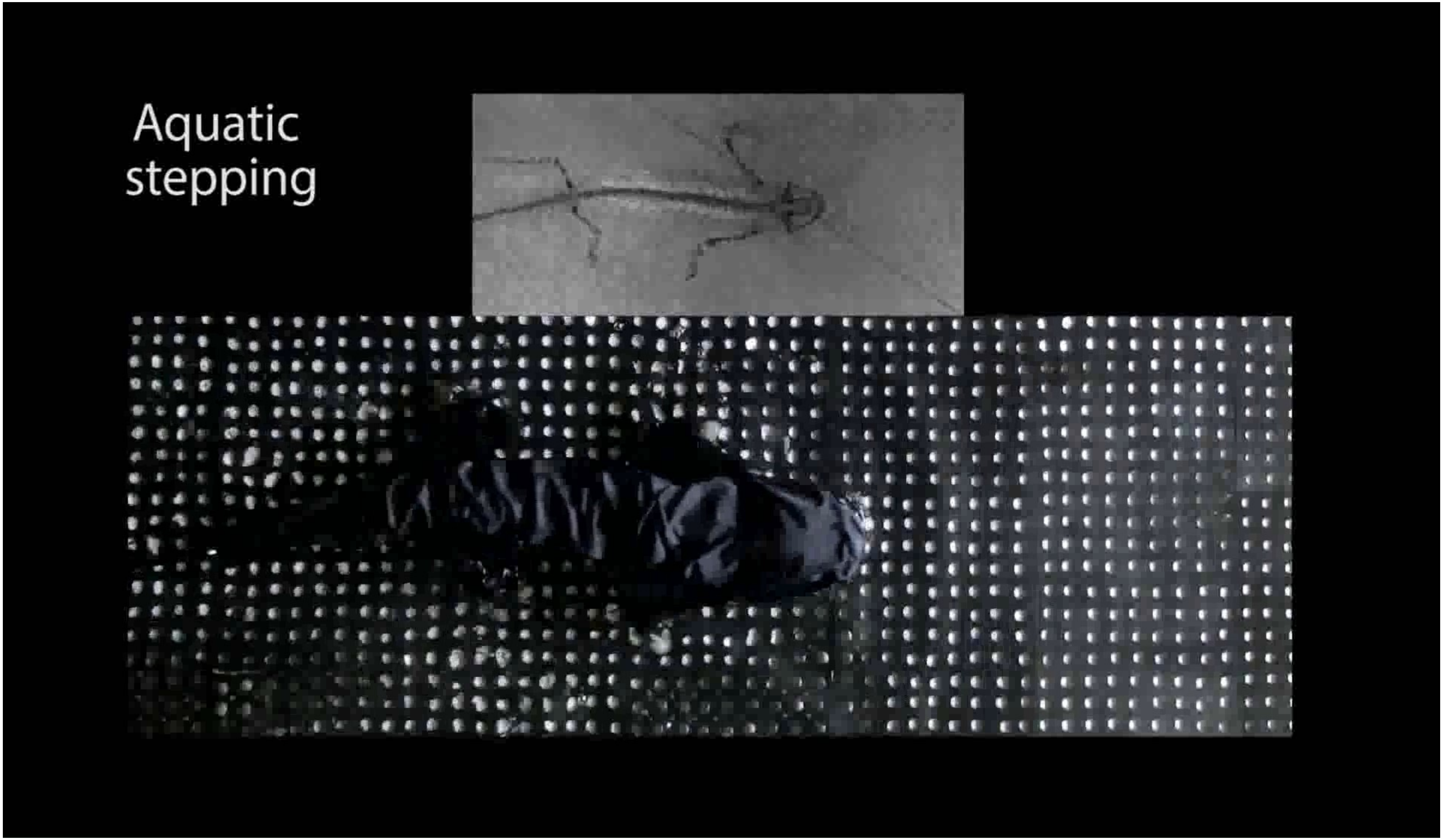
Animal Aquatic Stepping

Pleurobot Aquatic Stepping



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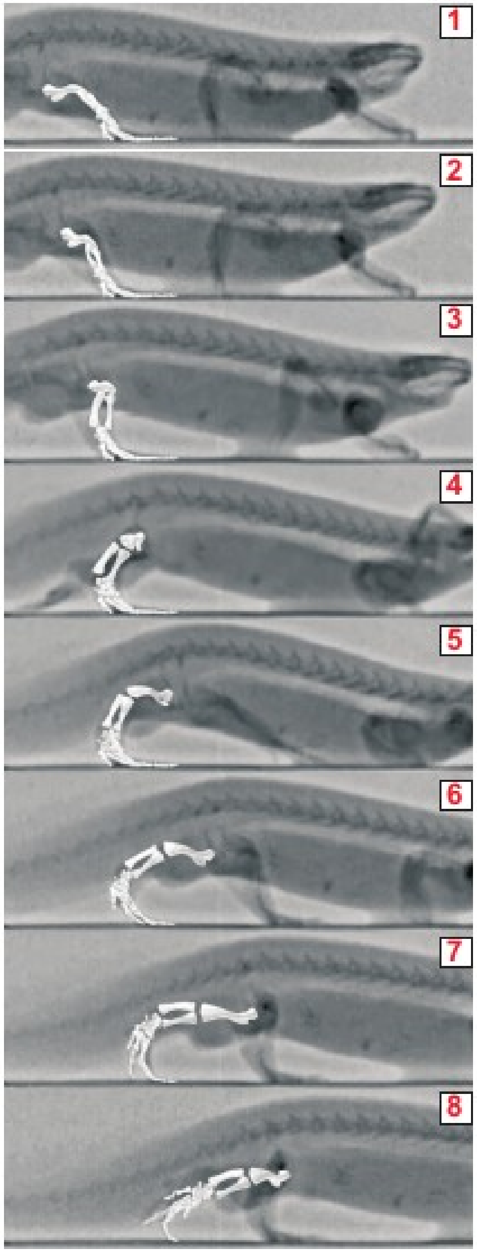
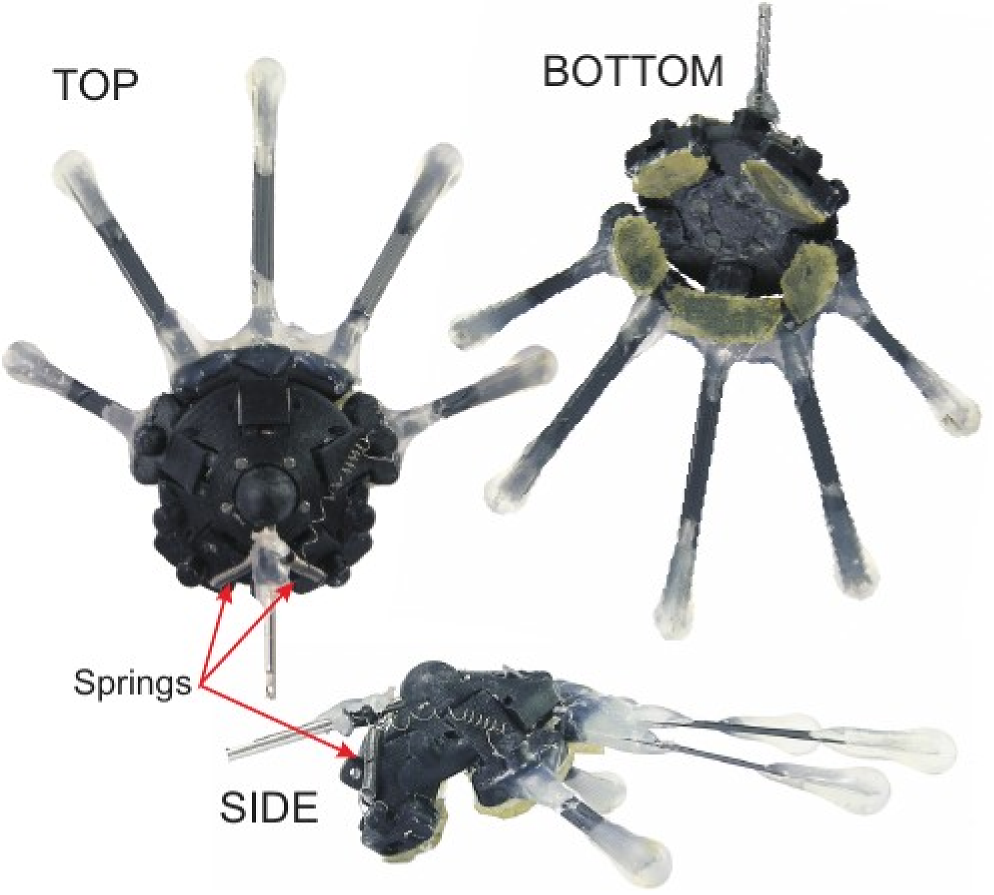
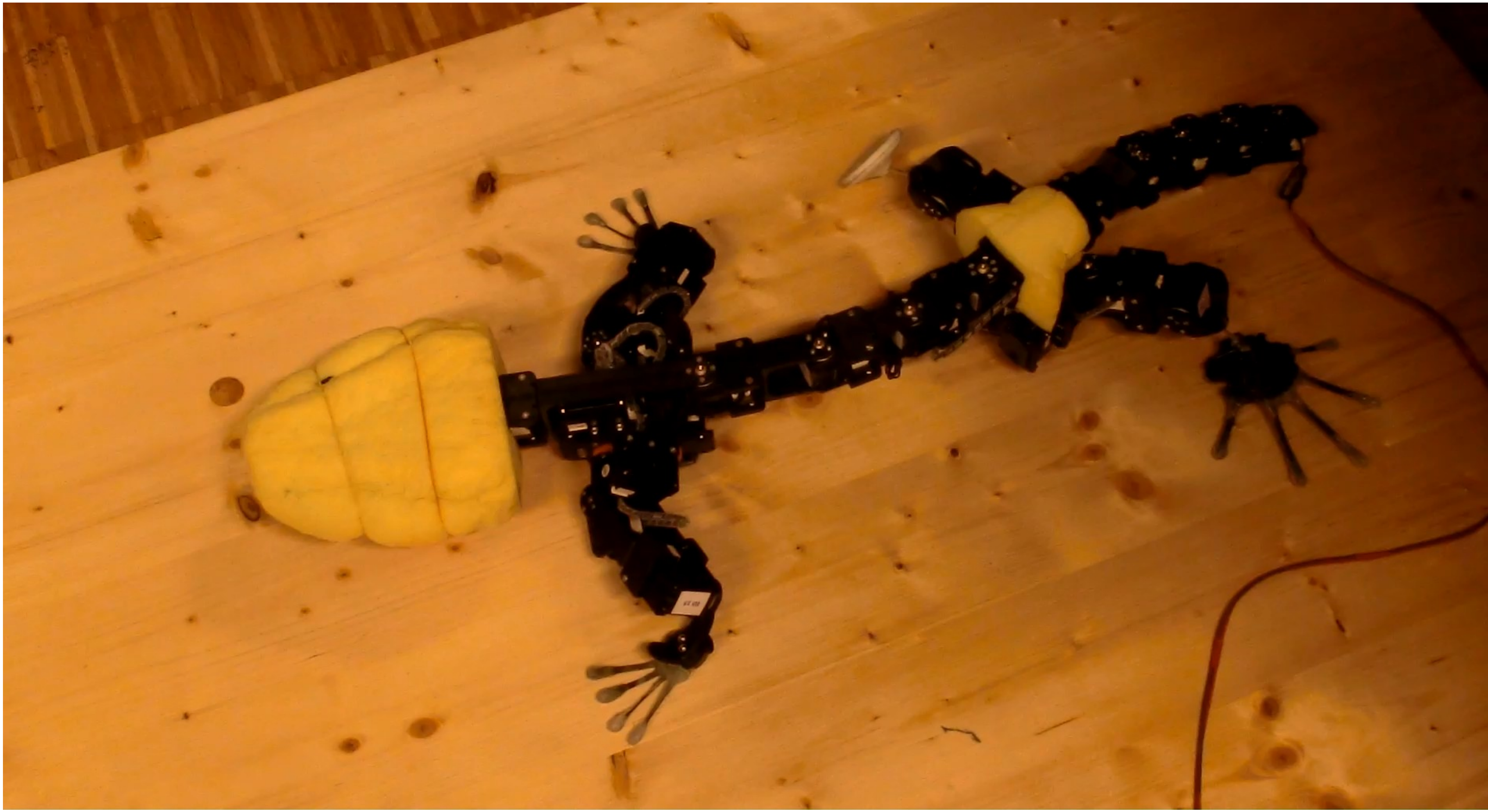
Previous works on design leg



Reconstruct Leg Kinematics
Student: Reza Safai



Student: Patrick Shwizer



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Purpose

Develop a **methodology for generic foot design**, in sprawling posture undulatory-spine-based robots.

Lizard locomotion 1:

High-speed qudrupedal and bipedal running

Zebra-tailed lizard (*Callisaurus draconoides*)

Dr. Bruce C. Jayne

Department of Biological Sciences

UNIVERSITY OF Cincinnati

Project components

Develop a **methodology for generic foot design**, in sprawling posture undulatory-spine-based robots.

- Design methodology (Niches in Taxonomy)
- Hardware design concept
- Experimentation, analysis and conclusions

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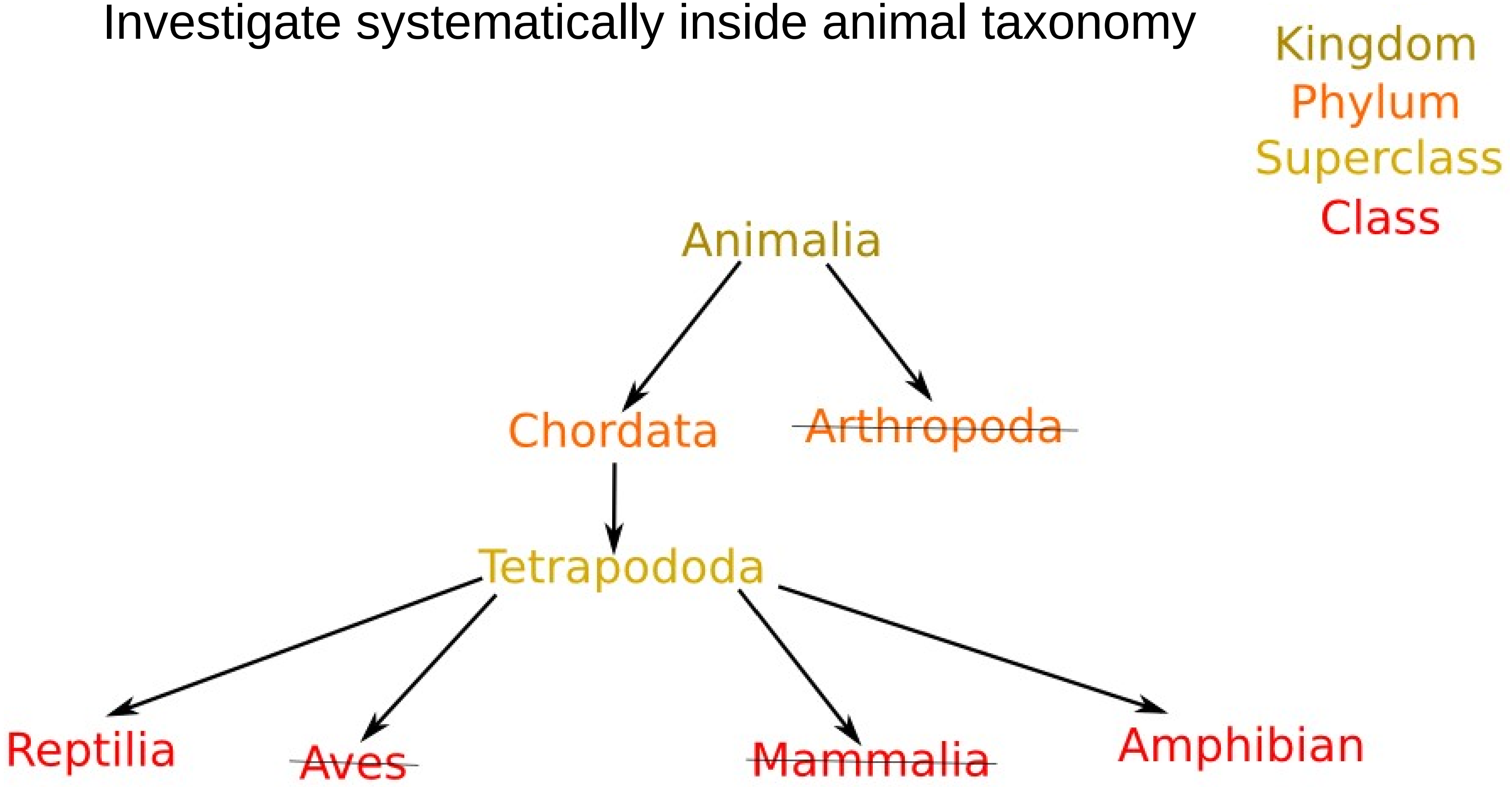
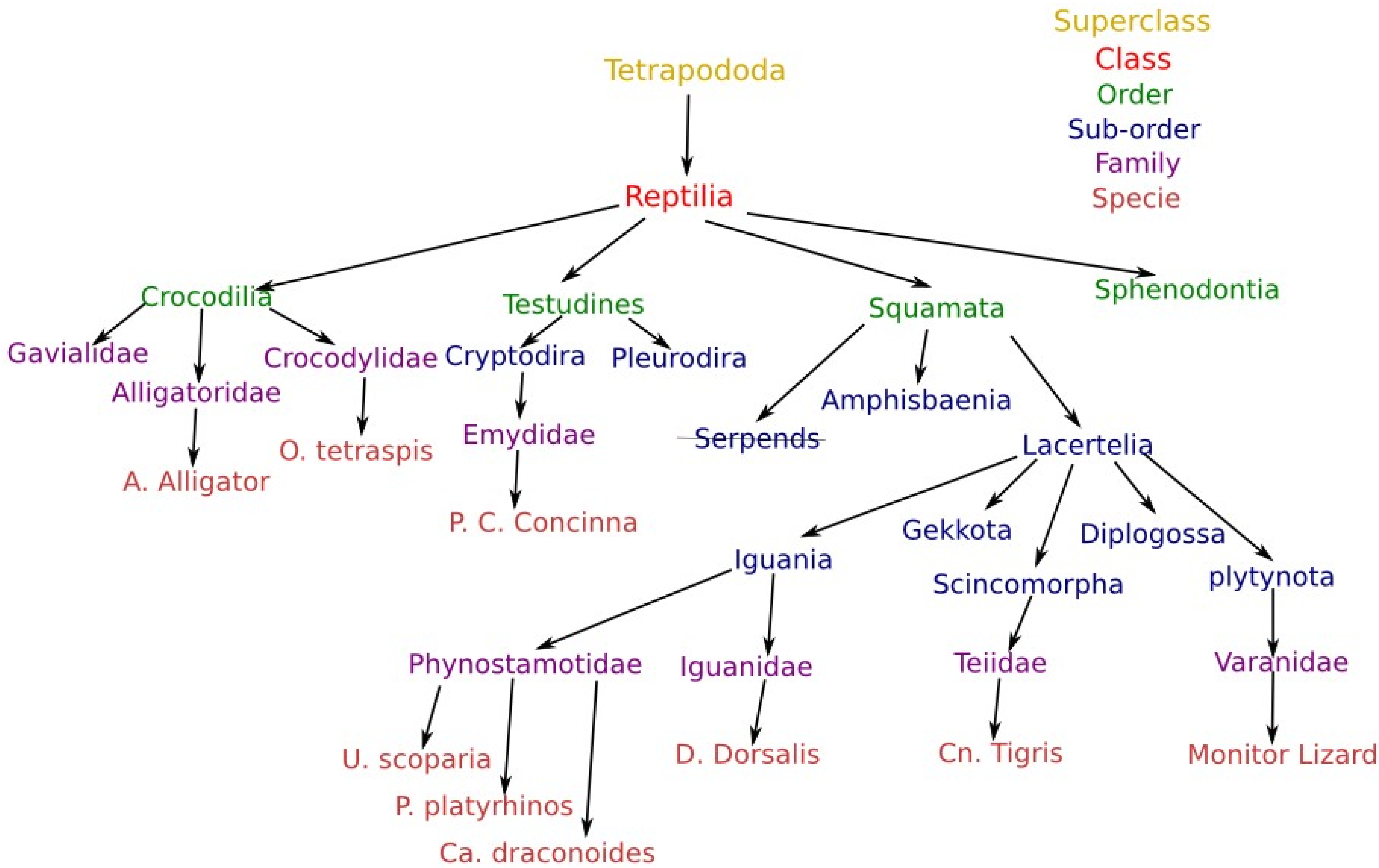
Biological classification (sprawling posture)

Investigate systematically inside animal taxonomy

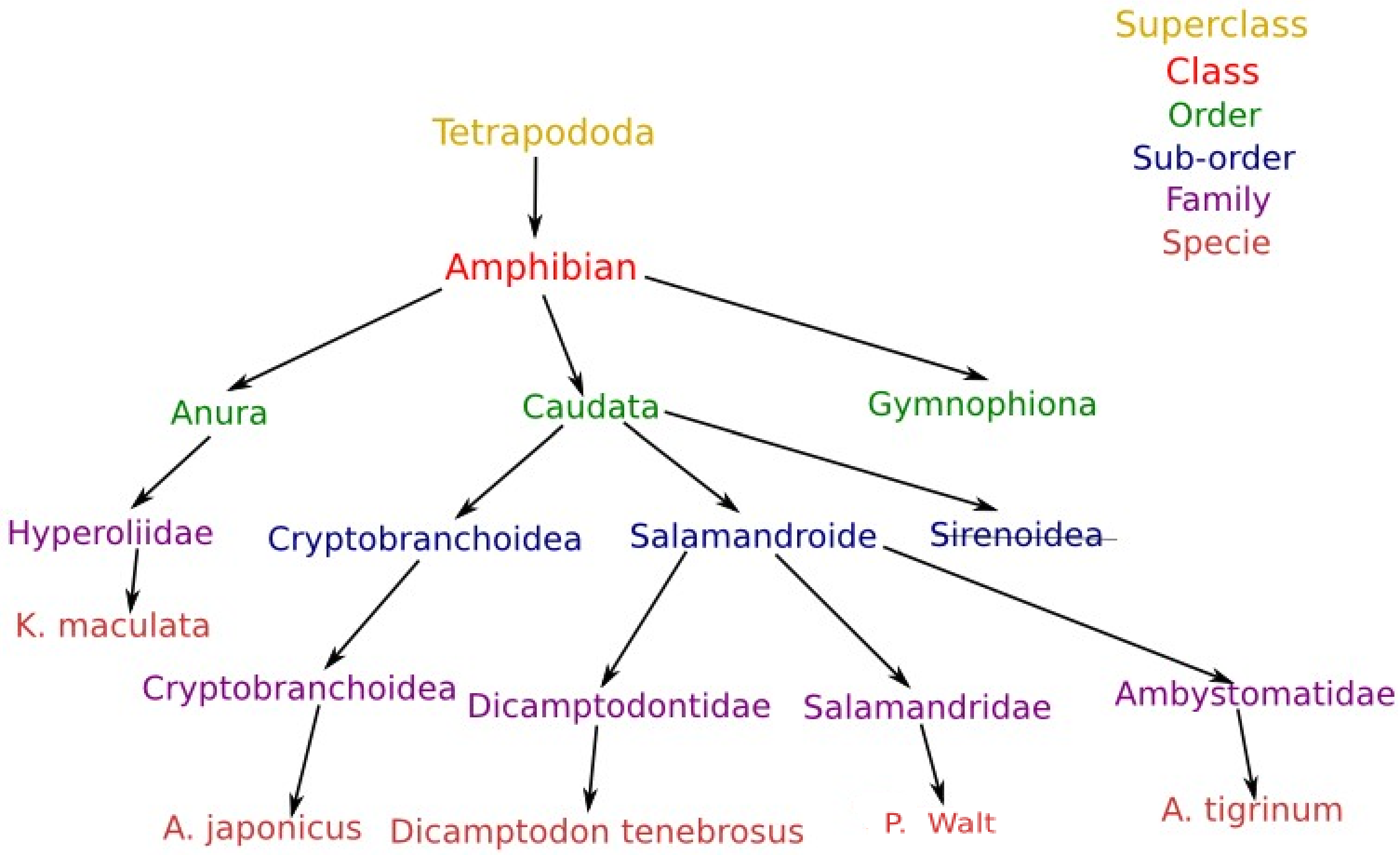


Biological classification (sprawling posture)

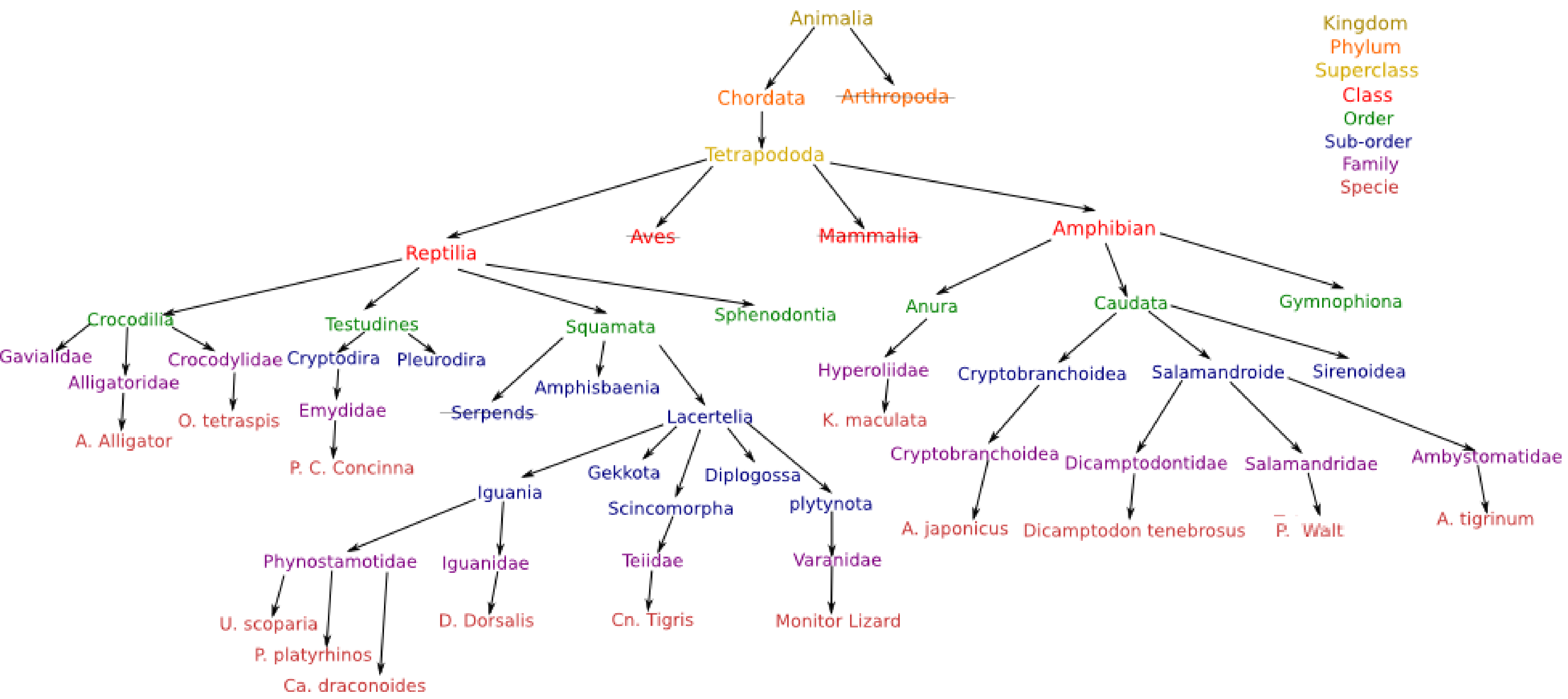


Representative animals

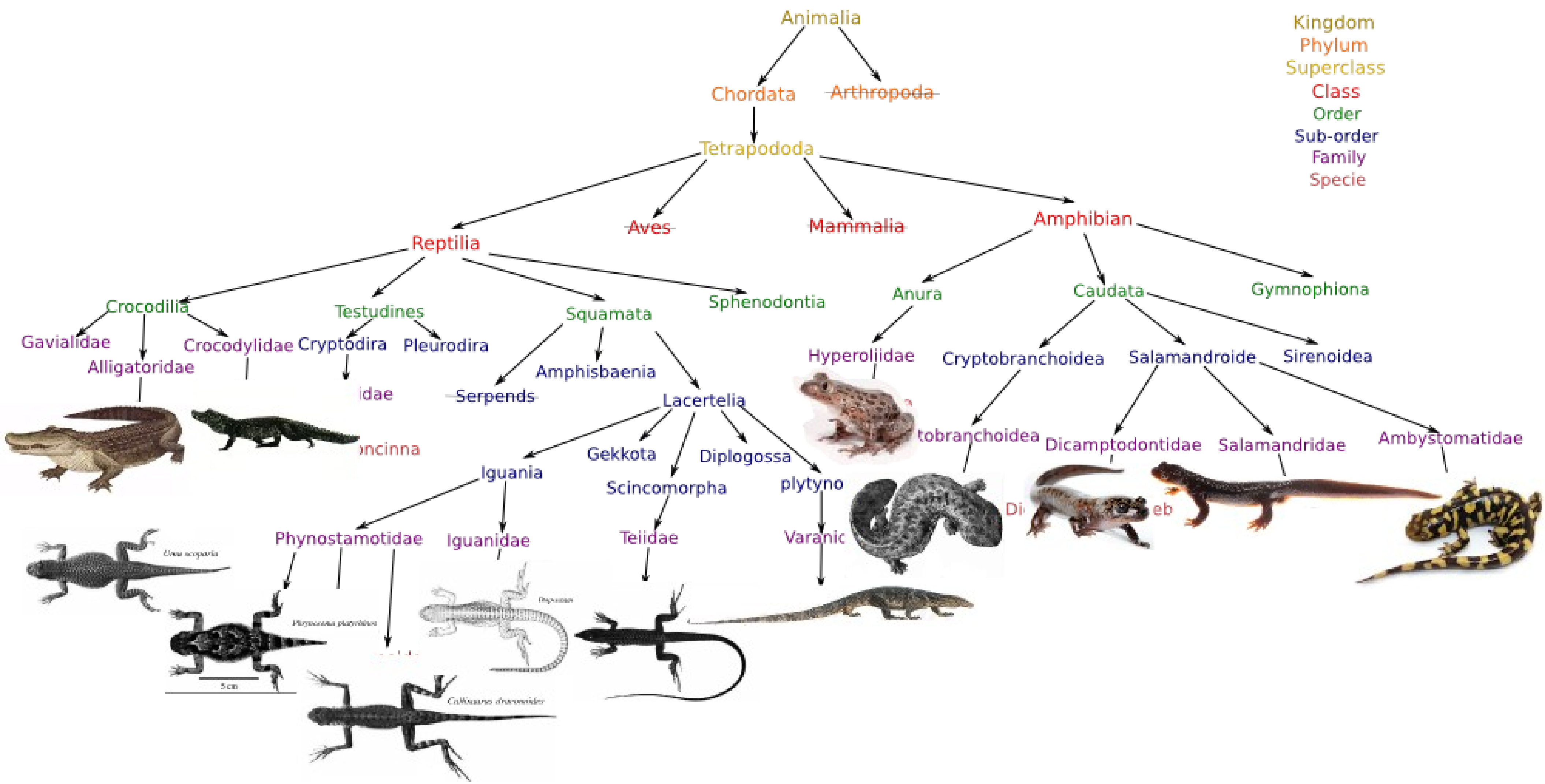
Biological classification (sprawling posture)



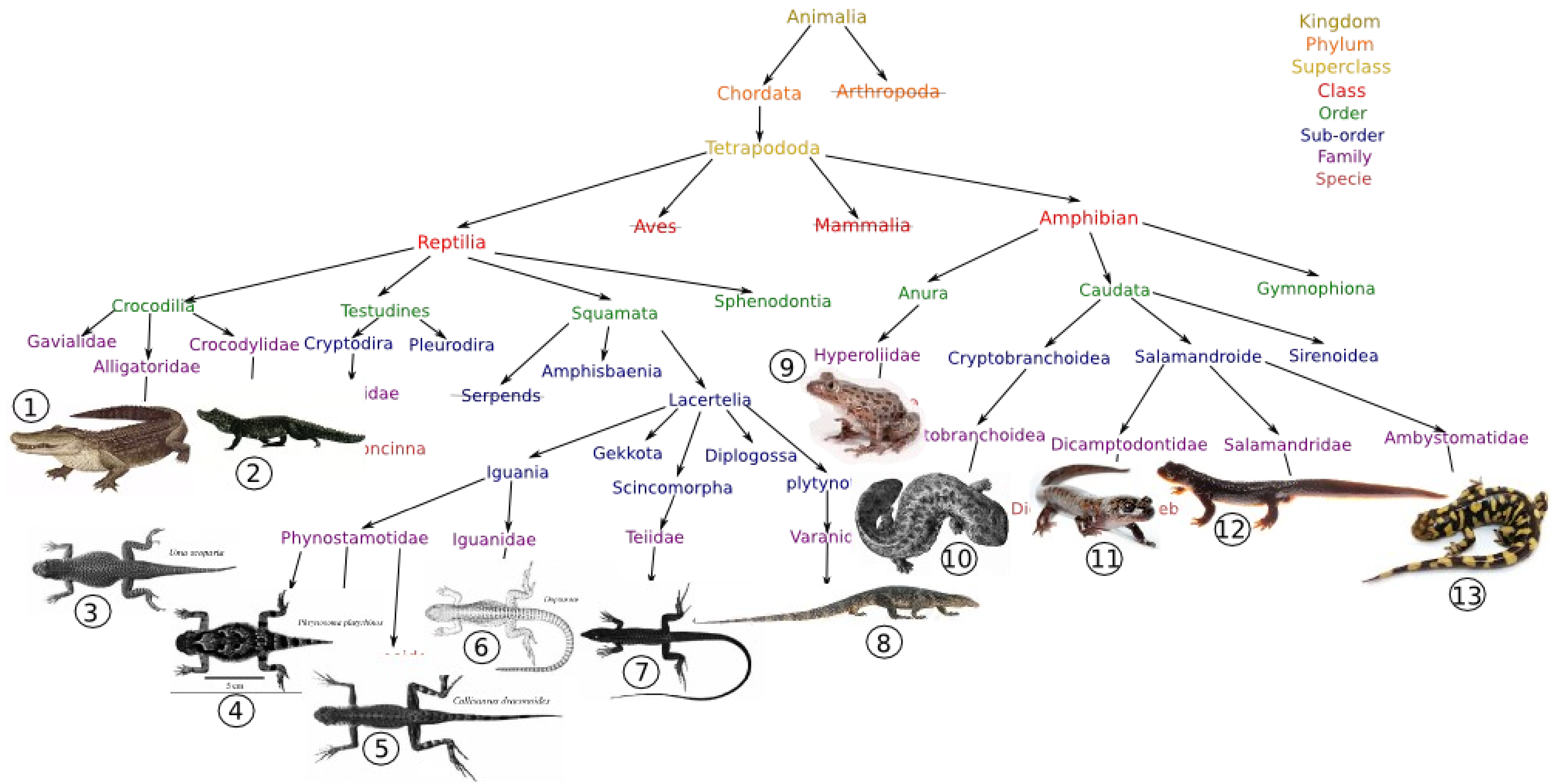
Biological classification (sprawling posture)



Biological classification (sprawling posture)

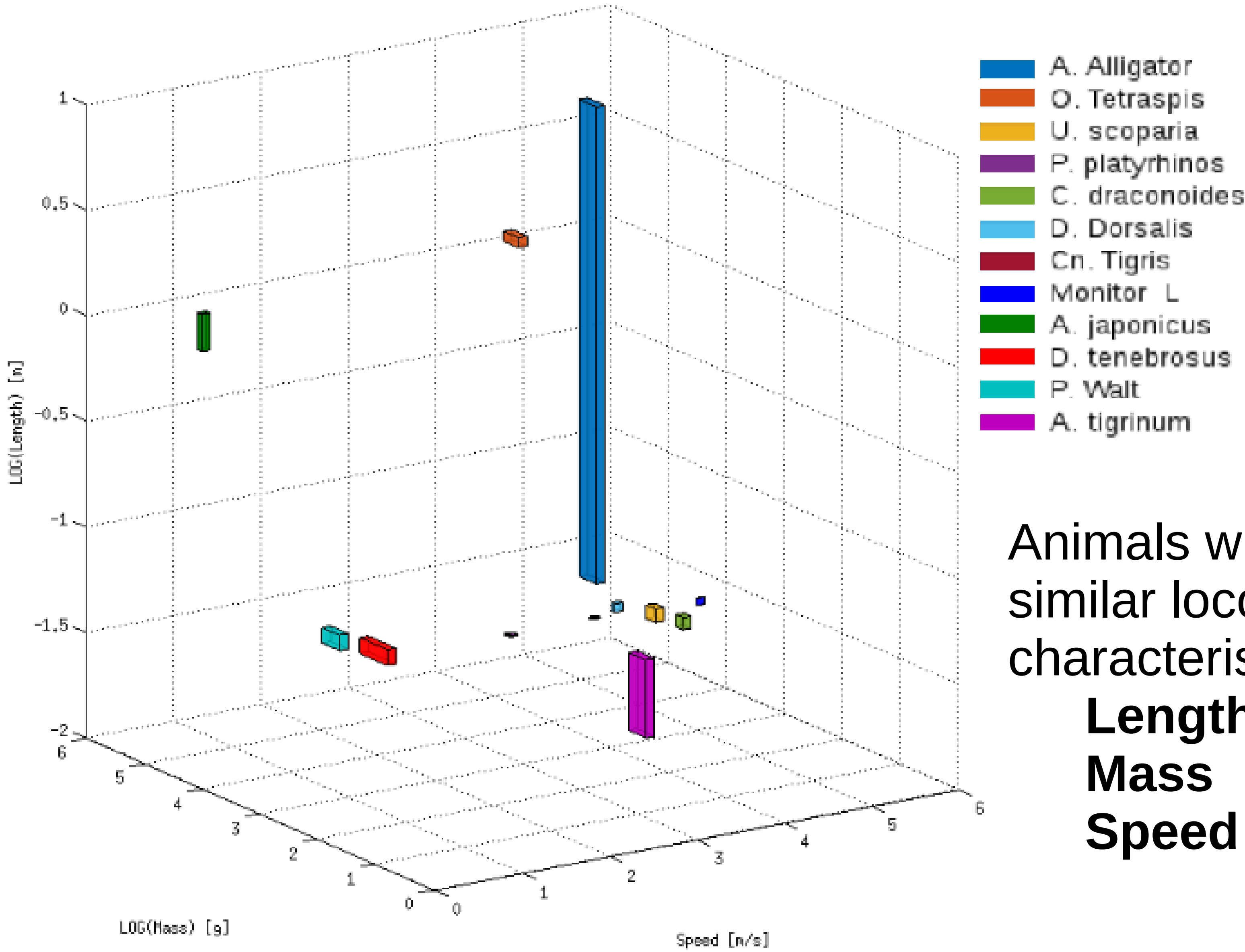


Biological classification (sprawling posture)



	A. Alligator	O. Tetraspis	U. scoparia	P. platyrhinos	C. draconoides	D. Dorsalis	Cn. Tigris	Monitor L	K. maculata	A. japonicus	D. tenebrosus	P. Walt	A. tigrinum
Speed (m/s)	6.667	4.722	3.8-4.1	2.0-2.2	4.1-4.3	3.6-3.7	3.15-3.25	6.3	0.10– 0.30	0.32	0.062293-0.27898	0.053	4.722
Mass (g)	181000–363000	18000-32000	20.22-13.78	23.03-28.37	8.0-11.0	22.35-25.65	16.3-18.3	1243	6.61- 10.05	25000-30000	14-42	50-100	113-227
Length (m)	0.025- 4.5	1.7 - 1.9	0.074-0.086	0.0785-0.0795	0.071-0.081	0.083-0.091	0.085-0.0859	0.041	0.04-0.048	1-1.5	0.0809 – 0.0962	0.0845-0.1	0.015-0.035
	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬

Biological classification (sprawling posture)



Animals with similar locomotion characteristics:

- **Length**
- **Mass**
- **Speed**

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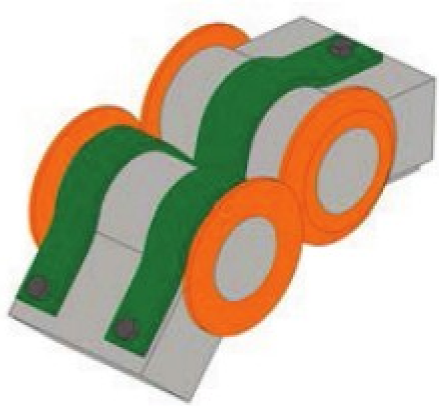
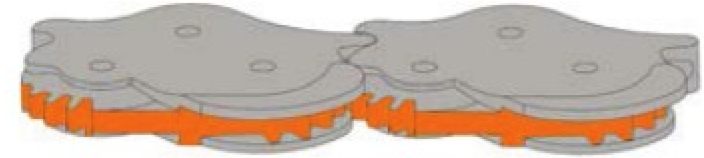
Hillberry joint

- Pair of cylinders in rolling contact on each other
- Low friction and abrasive wear.
- Elastic ligaments

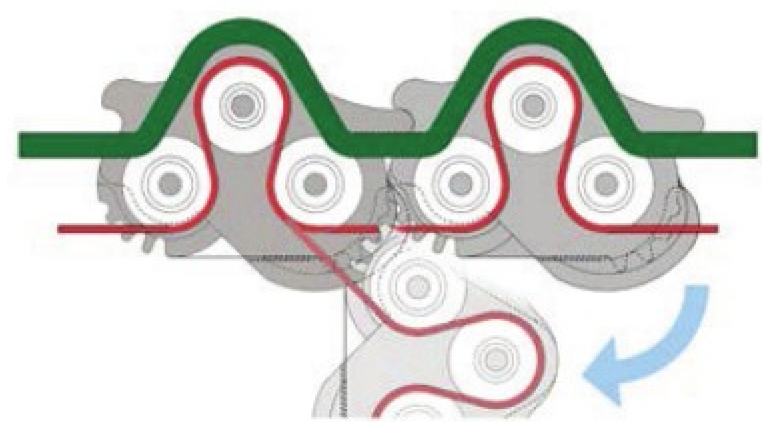


Adapted

(a) Perspective view



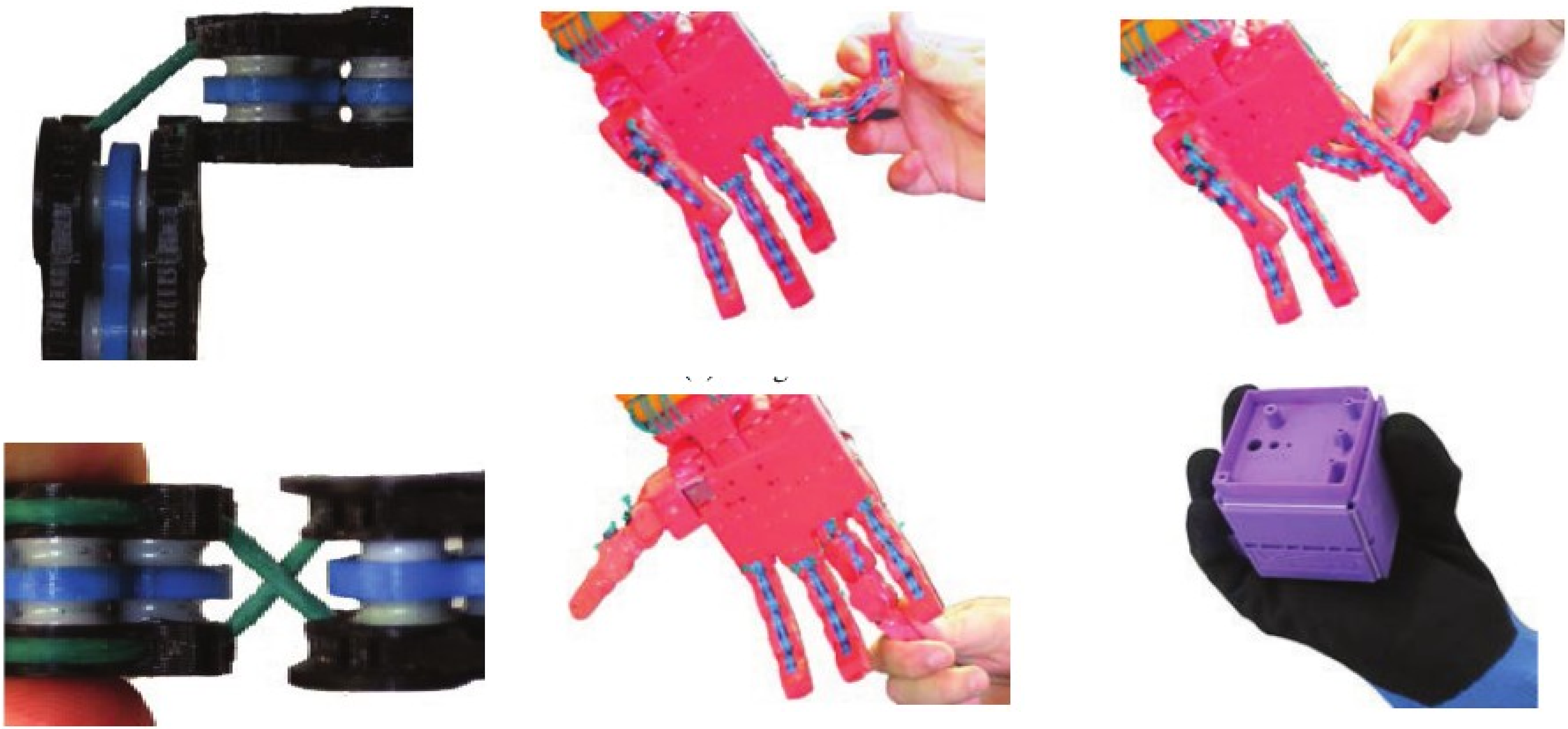
(b) Side view and movement



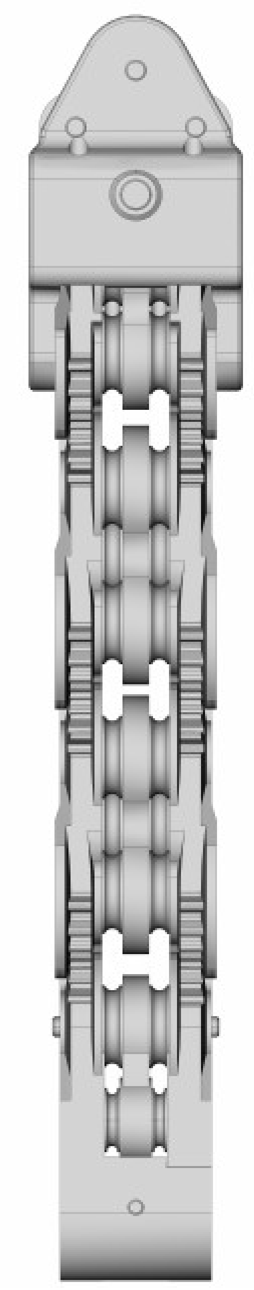
M. G. Catalano, Grioli, G., Farnioli, E., Serio, A., Piazza, C., and Bicchi, A., “Adaptive Synergies for the Design and Control of the Pisa/IIT SoftHand”, International Journal of Robotics Research, vol. 33, no. 5, pp. 768–782, 2014

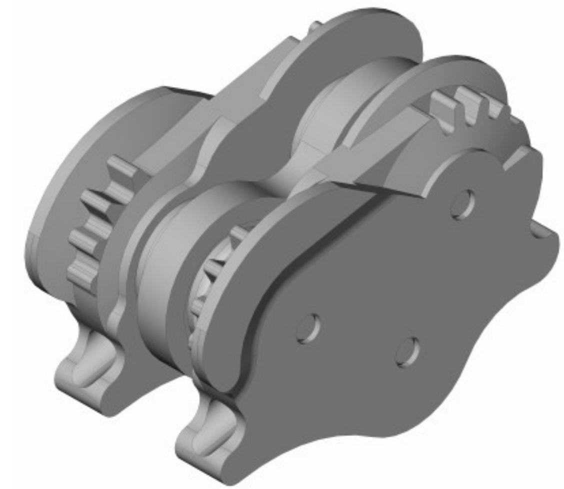
Pisa/IIT SoftHand

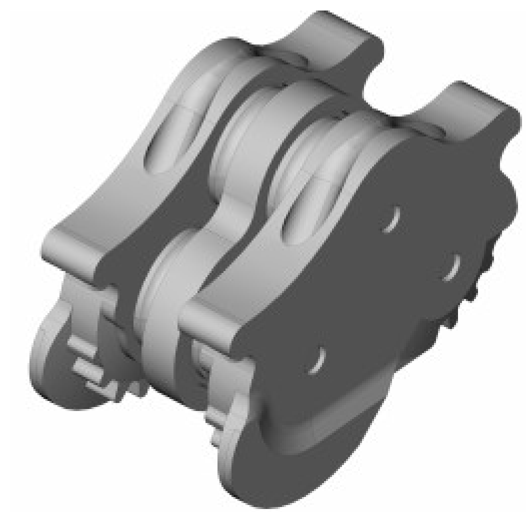
- The joint can withstand severe disarticulations and violent impacts



Finger Design







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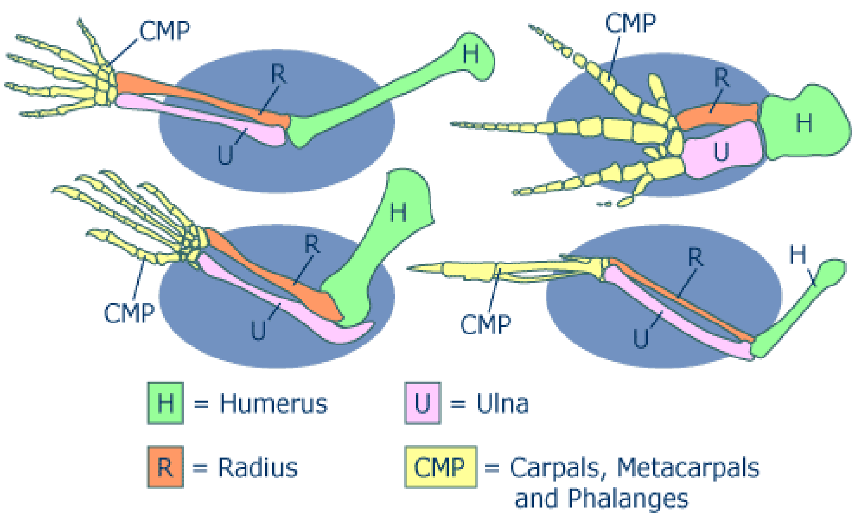
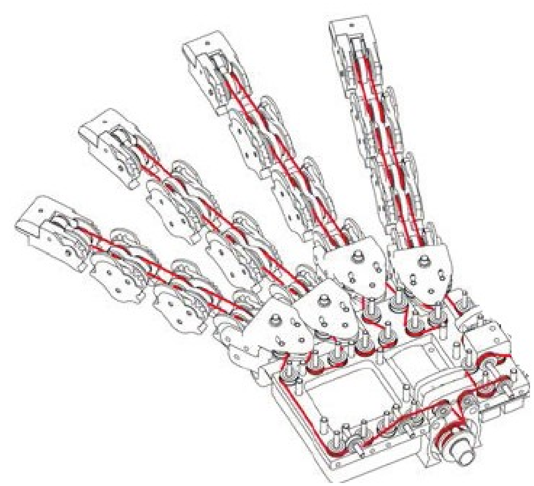
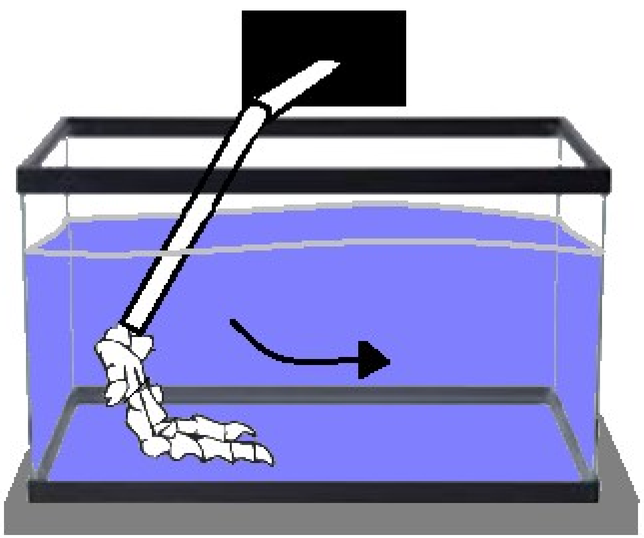
Design methodology (Niches in Taxonomy)



Hardware design concept



Experimentation, analysis and conclusions



Ground Reaction forces

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Questions?