CT-scanning of Vertebrate Fluid Specimens

Dave Blackburn
Associate Curator of Herpetology
Florida Museum of Natural History

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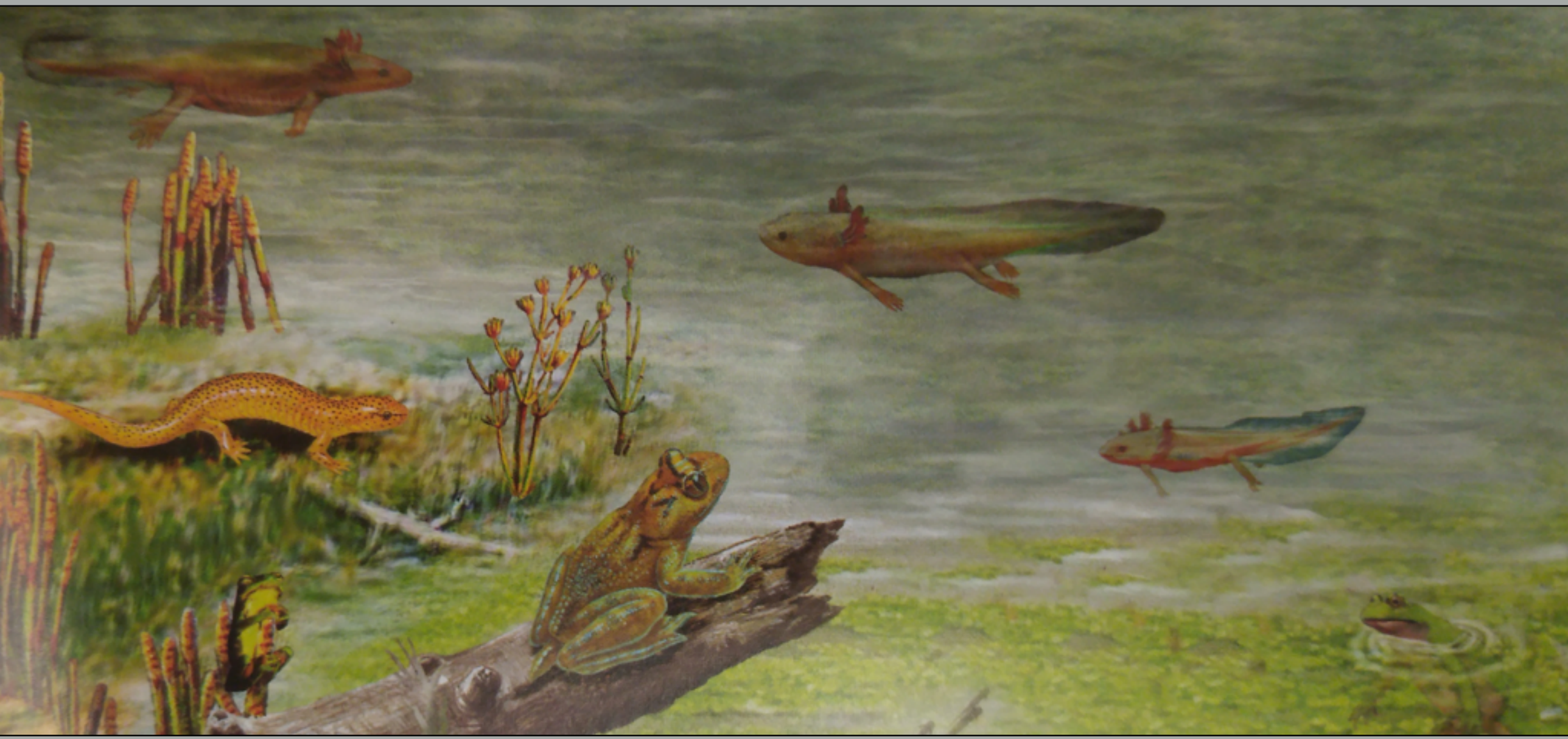

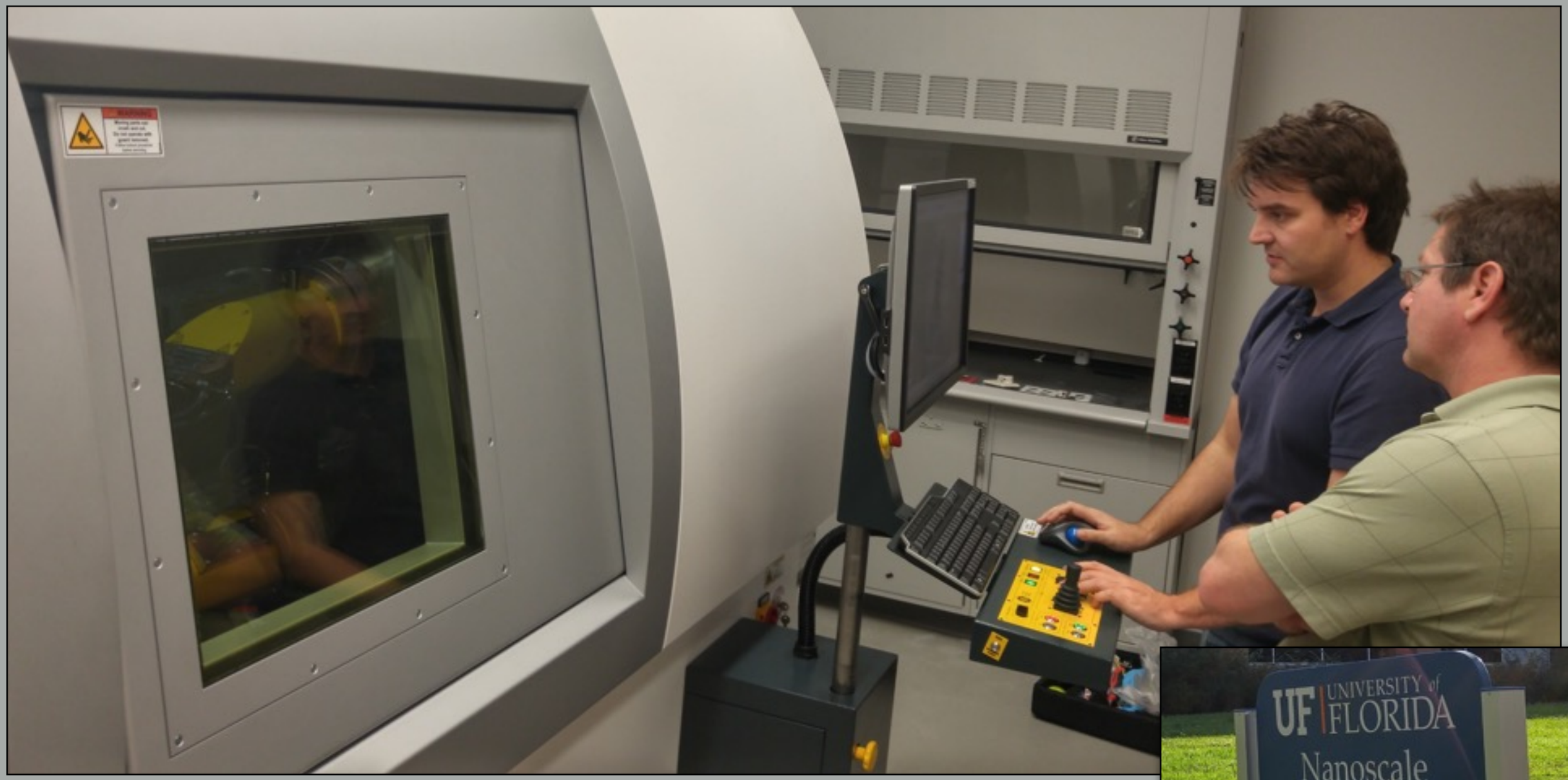

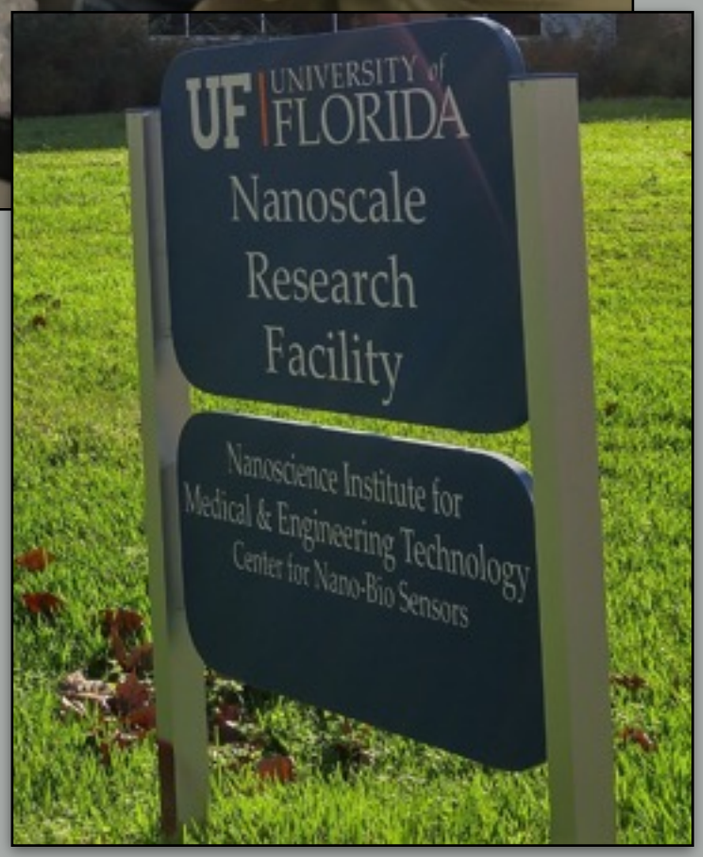

Nanoscale Research Facility at Univ. Florida

GE v|tome|x m 180 kV/240 kV dual-tube
with 16-inch detector plate

Broader Impacts of CT-scanning

Distribute images and 3D volumes

MORPHO SOURCE

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Projects

Illinois State Museum Vertebrate collections

This is an effort to digitize significant vertebrate collections curated in the Illinois State Museum, Springfield, IL. This is a collaboration between the Geology, Archaeology, and Zoology sections of the museum.

Members: Meredith Mahoney, Chris Widga

Data: 8 published media, 9 specimens

PROJECT INFO

Institut Català de Paleontologia Miquel Crusafont specimens

Members: Douglas Boyer, Callie Crawford, Judit Marigó

Data: 14 published media, 14 specimens

PROJECT INFO

Specimens

ISM-GEO-406996, *Carcharocles auriculatus*

ISM-GEO-497312, *Mammut americanum*

ISM-GEO-497337, *Edestu*

ISM-GEO-498593, *Ursus*

ISM-GEO-ISM 499311, *M*

ISM-GEO-Zimmerman Ca

ISM-ZOO-693928, *Puma*

Creative 3D printing

Benefits of CT-scanning

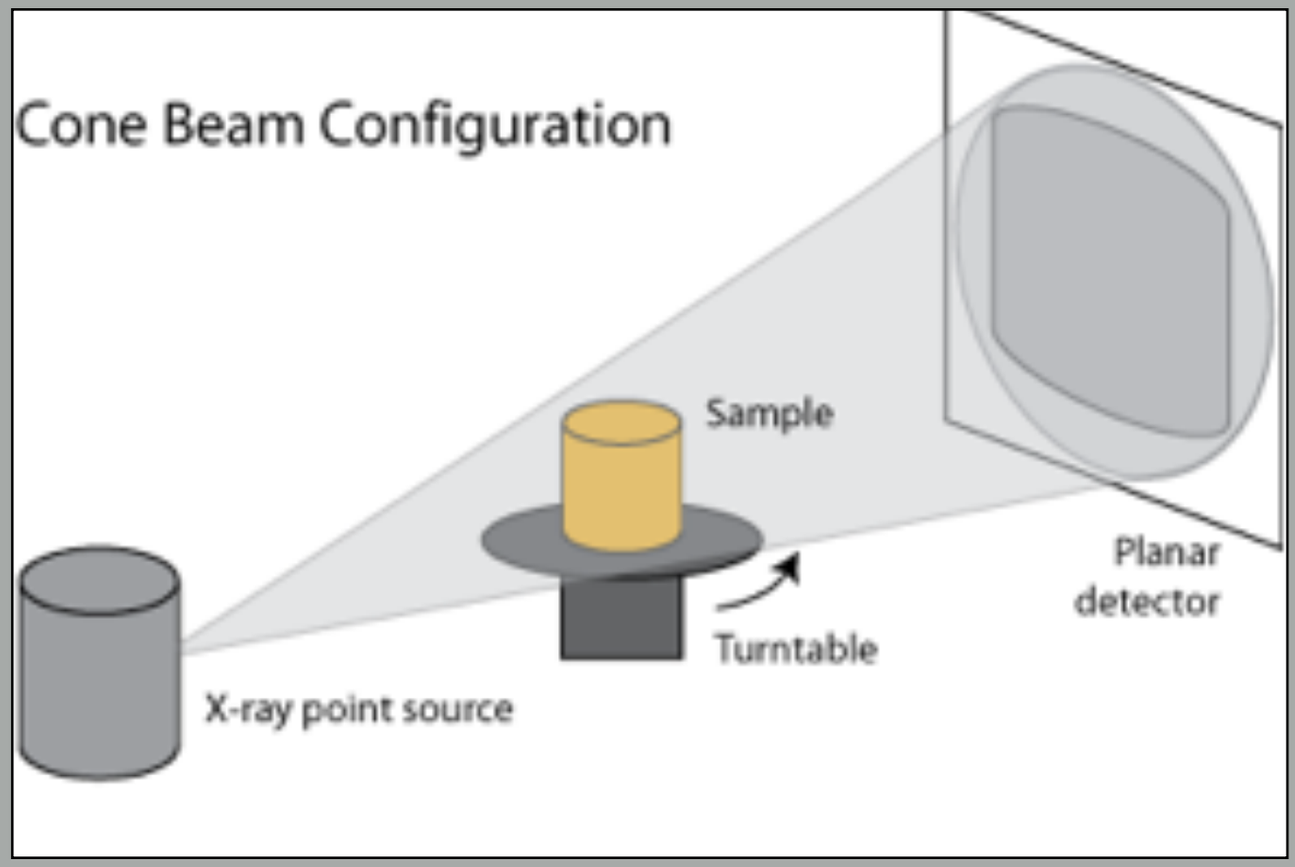
- Non-destructive Dissection
  - Qualitative Morphology
  - Quantitative Morphology: Volumes, Surface Areas, Densities…
  - Precise Measurements of Internal and External Anatomy
  - Conservation of Unique Specimens
  - Comparable Data for Extant and Paleo Collections
- Digitally Record of Whole Specimen
  - Create Digital Specimens with High Resolution (2–100 microns)
  - Share Results Easily with Peers and Public
- Fast, Accurate Results
  - Preparation is Simple
  - Same Results As Cutting/Dissecting
- Relatively Easy
  - Can ‘image’ through a low-density container

Limits of CT-scanning

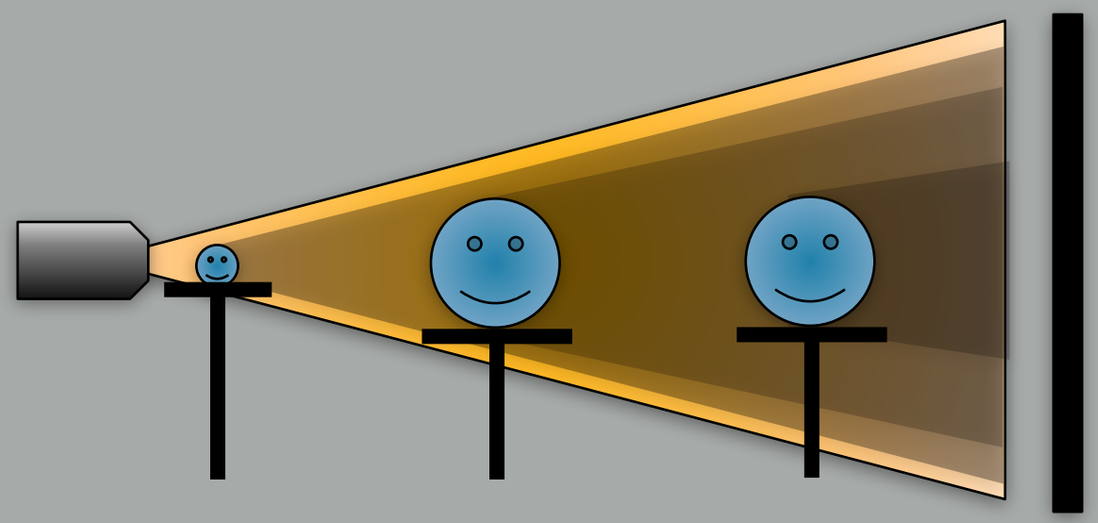
- Depends on Availability of a CT-Scanner
  - Rates vary for internal and external users!
  - Need to reserve time on busy machines
- Can be Costly
  - Most academic institutions charge internal rates of < $60/hr
  - Reconstruction workstations and licensed software can be expensive
  - Need lots of data storage
- Samples must not move!

Basics of microCT-scanning

- X-ray tube creates cone beam
- Sample between source and detector
- Detector is X-ray sensitive
- Magnification based on proximity of sample to source

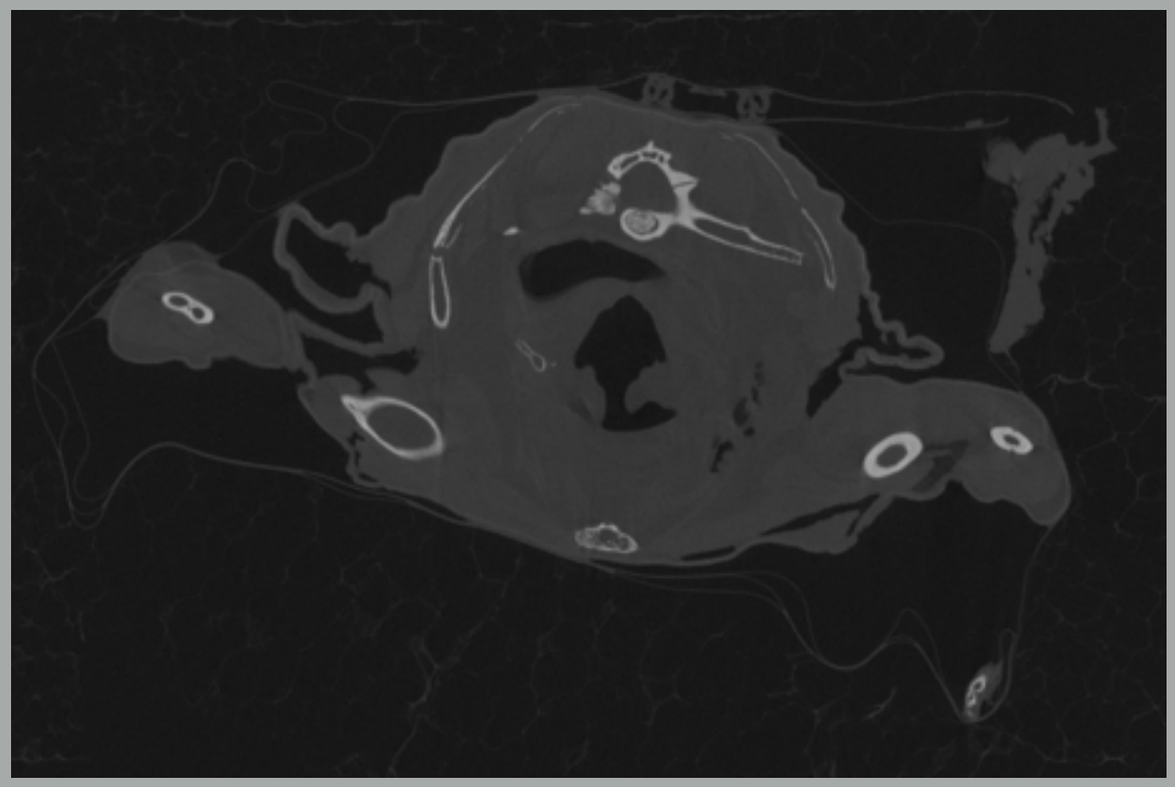


http://serc.carleton.edu/research_education/geochemsheets/techniques/CT.html

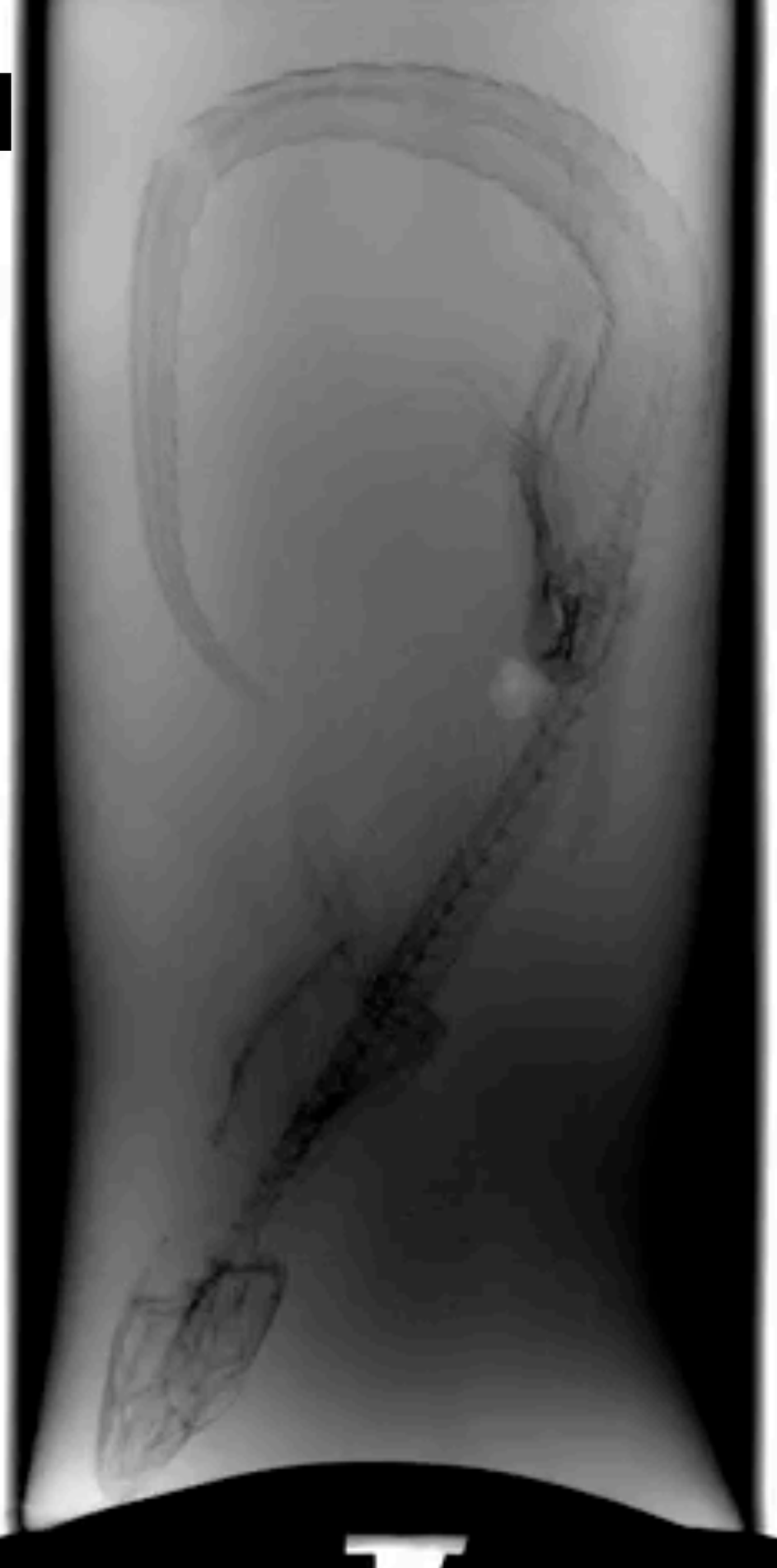


CT Imaging vs. ‘normal’ X-ray Imaging

- Computed Tomography Algorithm
- 3D Density map
  - 2D Slice = 3D Cross Section
    - Object Termed “Volume” or “Reconstruction”
  - 2D Pixel → 3D “Voxel”



X-ray



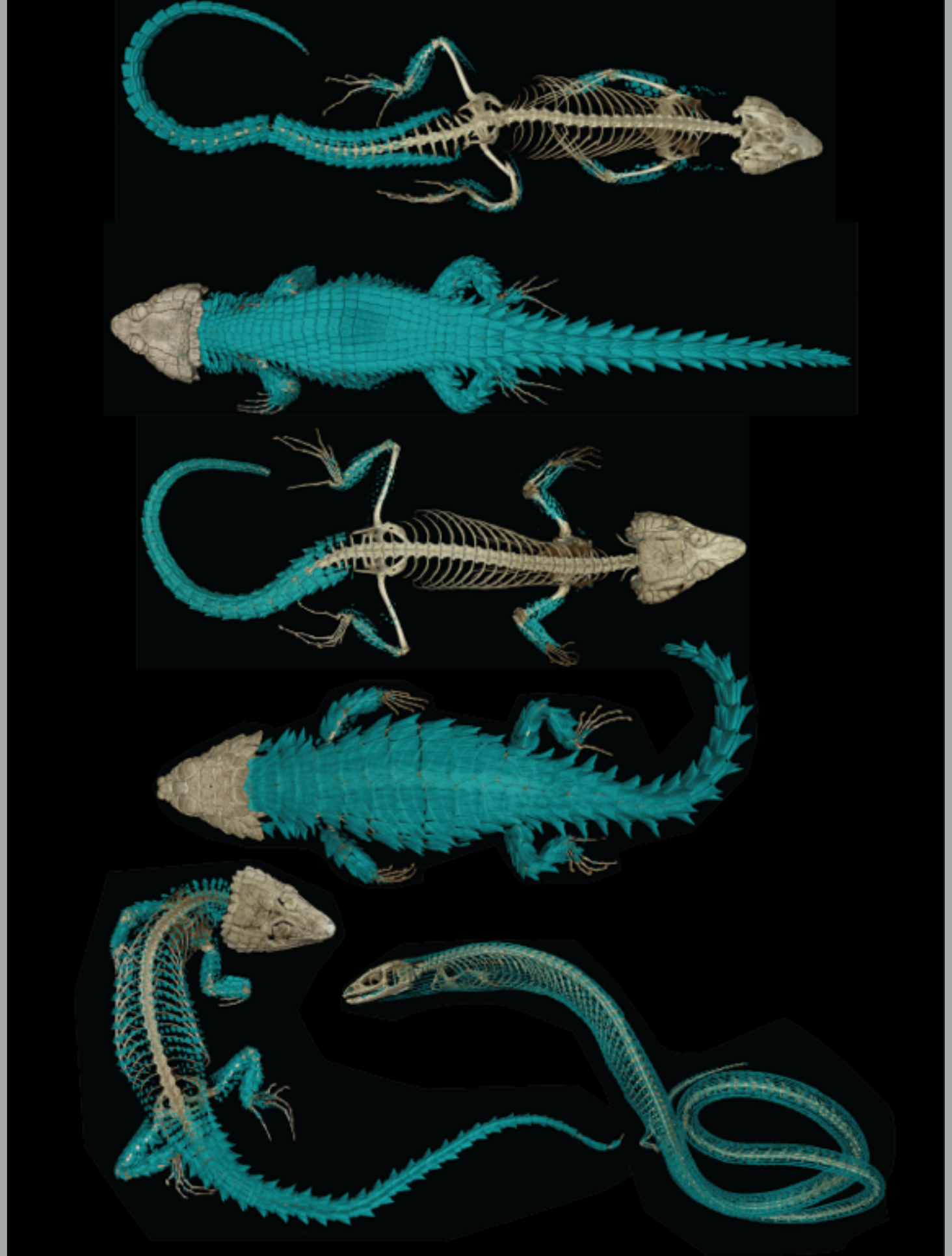
Z- Stack

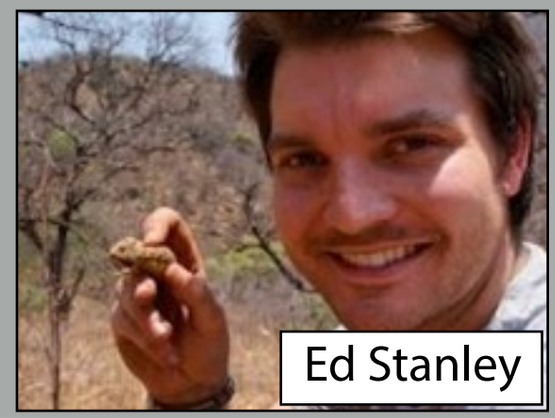
H. flavolineatum

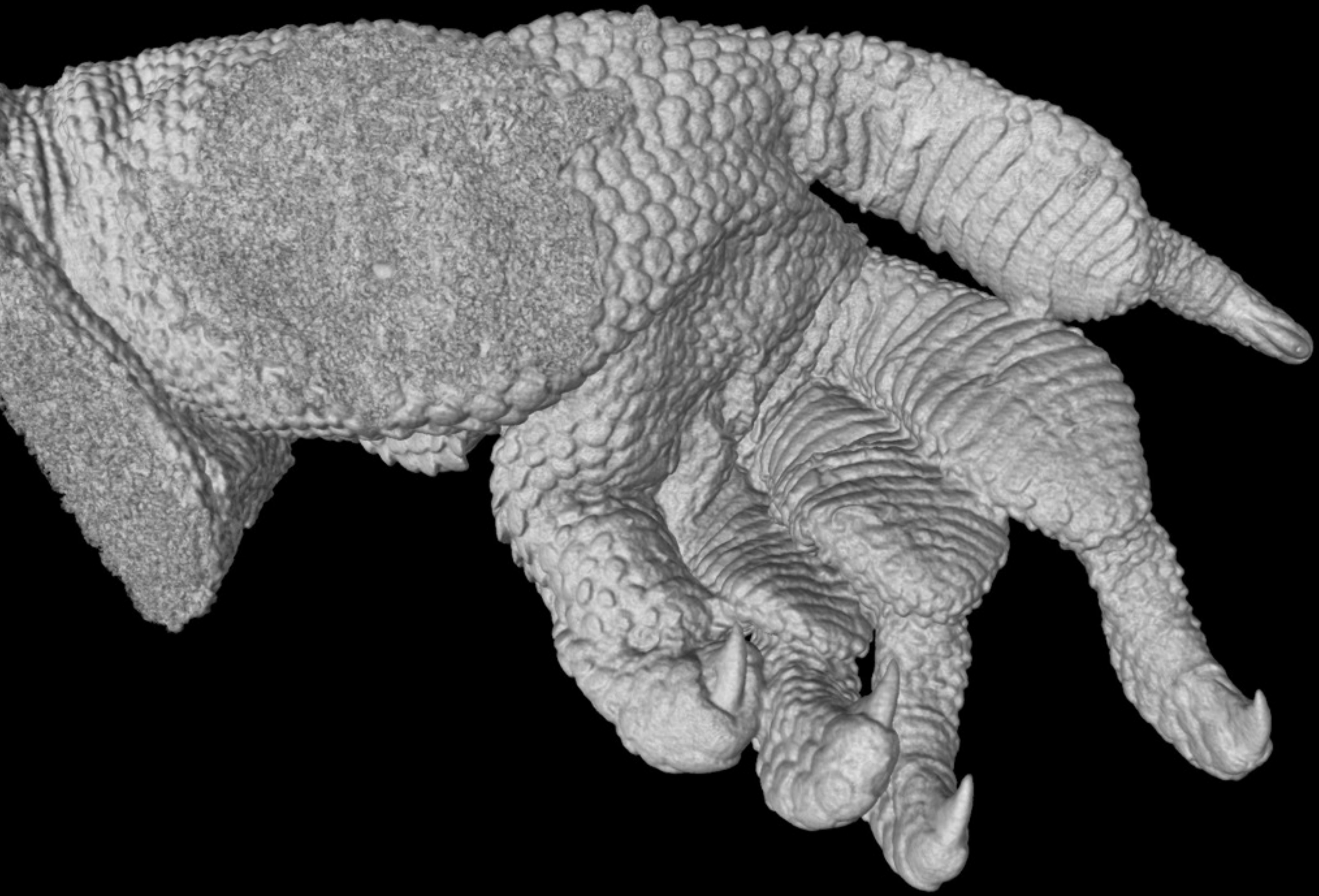
H. carbonarium

H. macrostomum

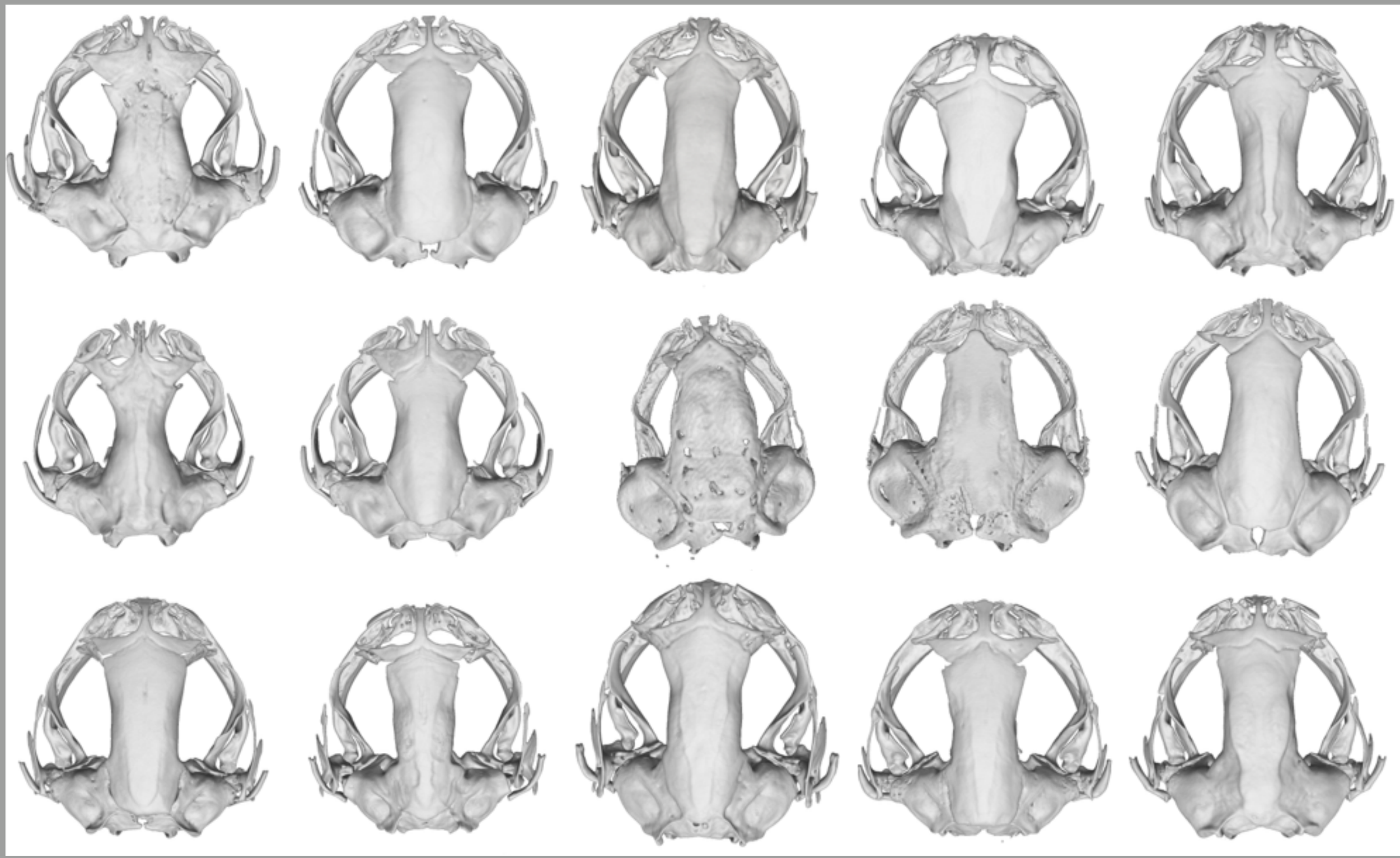
20mm




Ed Stanley



Diversity of *Xenopus* (African Clawed Frogs)



Incorporating CT-scanning into Collections Digitization

- Imaging a specimen at 50–100 micron resolution
  - 1–2 hours of scanning time
  - ~1 TB storage

- Create high-impact collections of digital specimens for:
  - Systematics
  - Morphological Diversity
  - Paleontology
  - Public engagement
  - and more…

Incorporating CT-scanning into Collections Digitization

- In addition to ‘traditional’ images of specimens

- Priorities @ UF Herpetology
  - Name-bearing type specimens
  - Florida amphibians and reptiles
  - Frogs of the World
  - Resources for teaching herpetology courses

- Grow Global Impact of Collections