

How to scan ALL the fishes



Adam P. Summers, UW - Friday Harbor Labs

@Fishguy_FHL

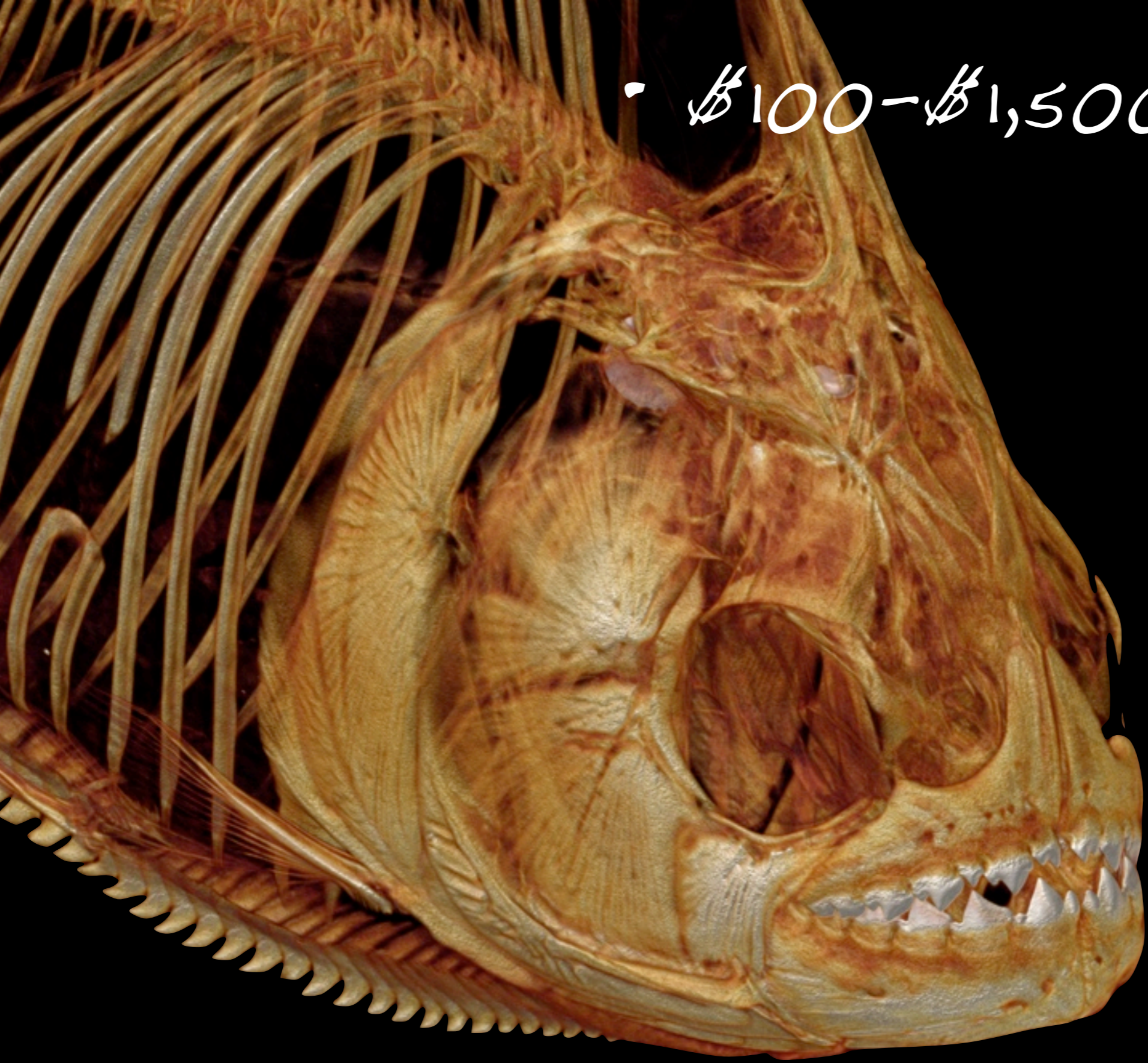
What is CT scanning?



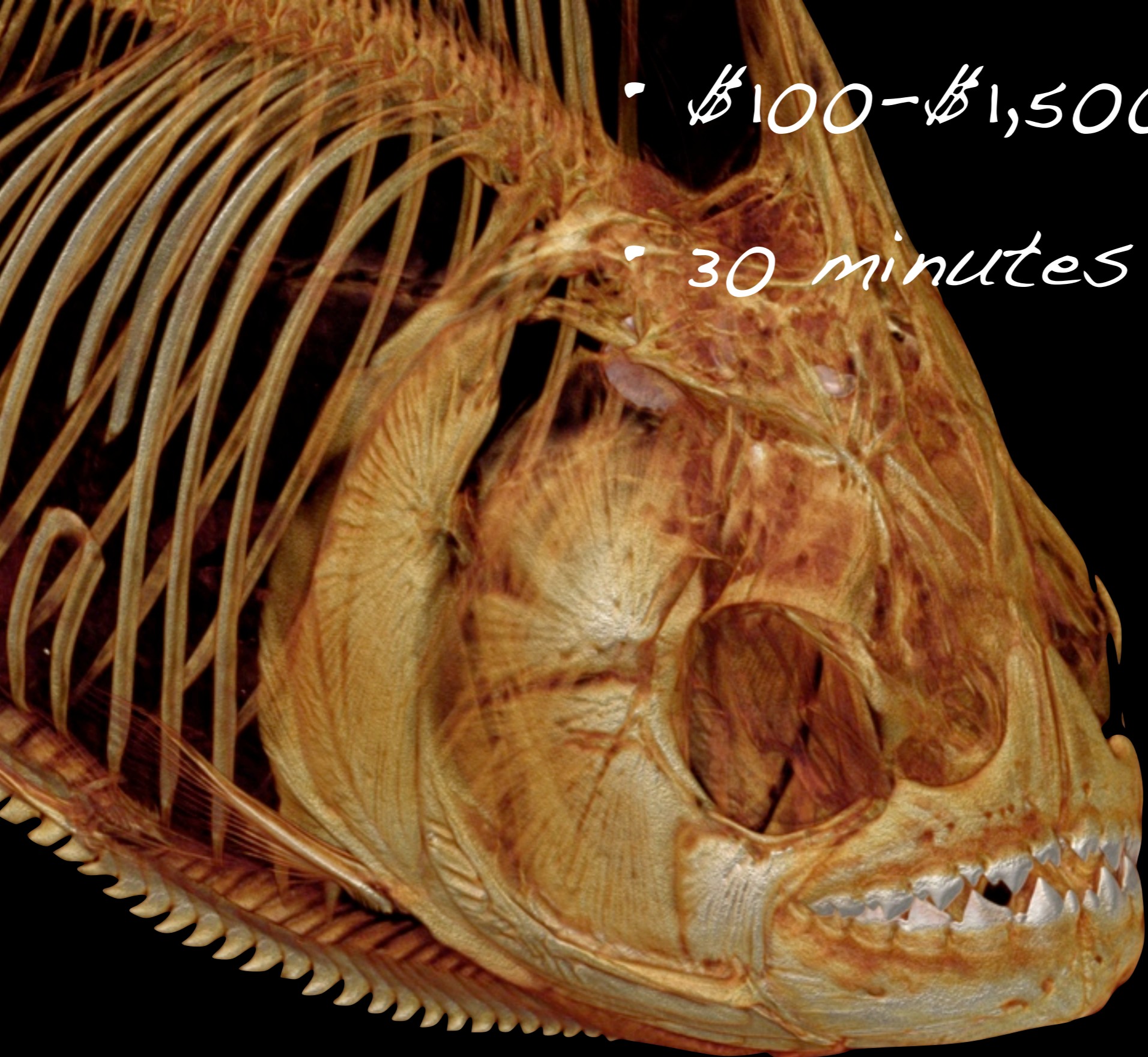


Serrasalmus medinae

• \$100-\$1,500 per scan



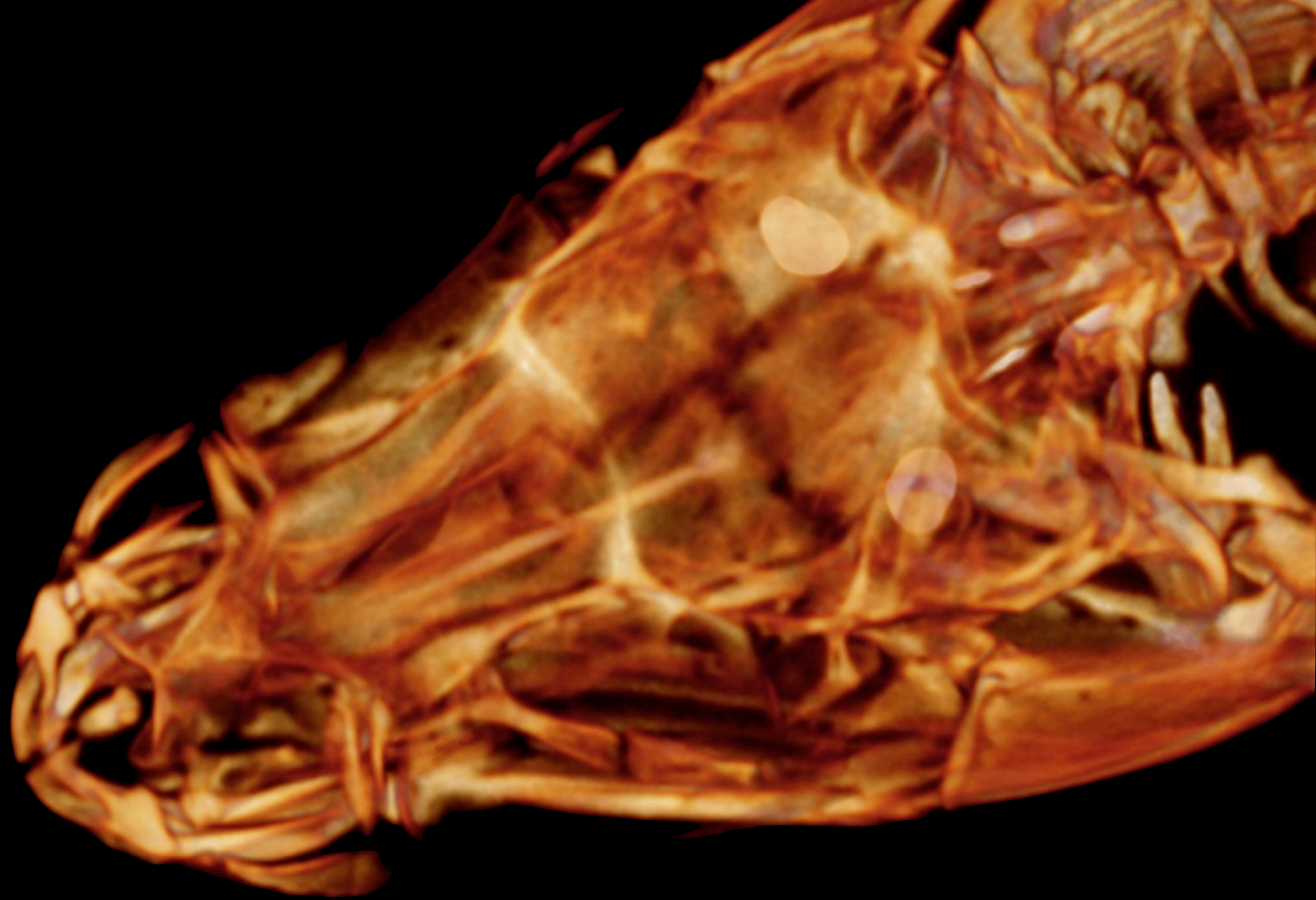
Serrasalmus medinae



• \$100-\$1,500 per scan

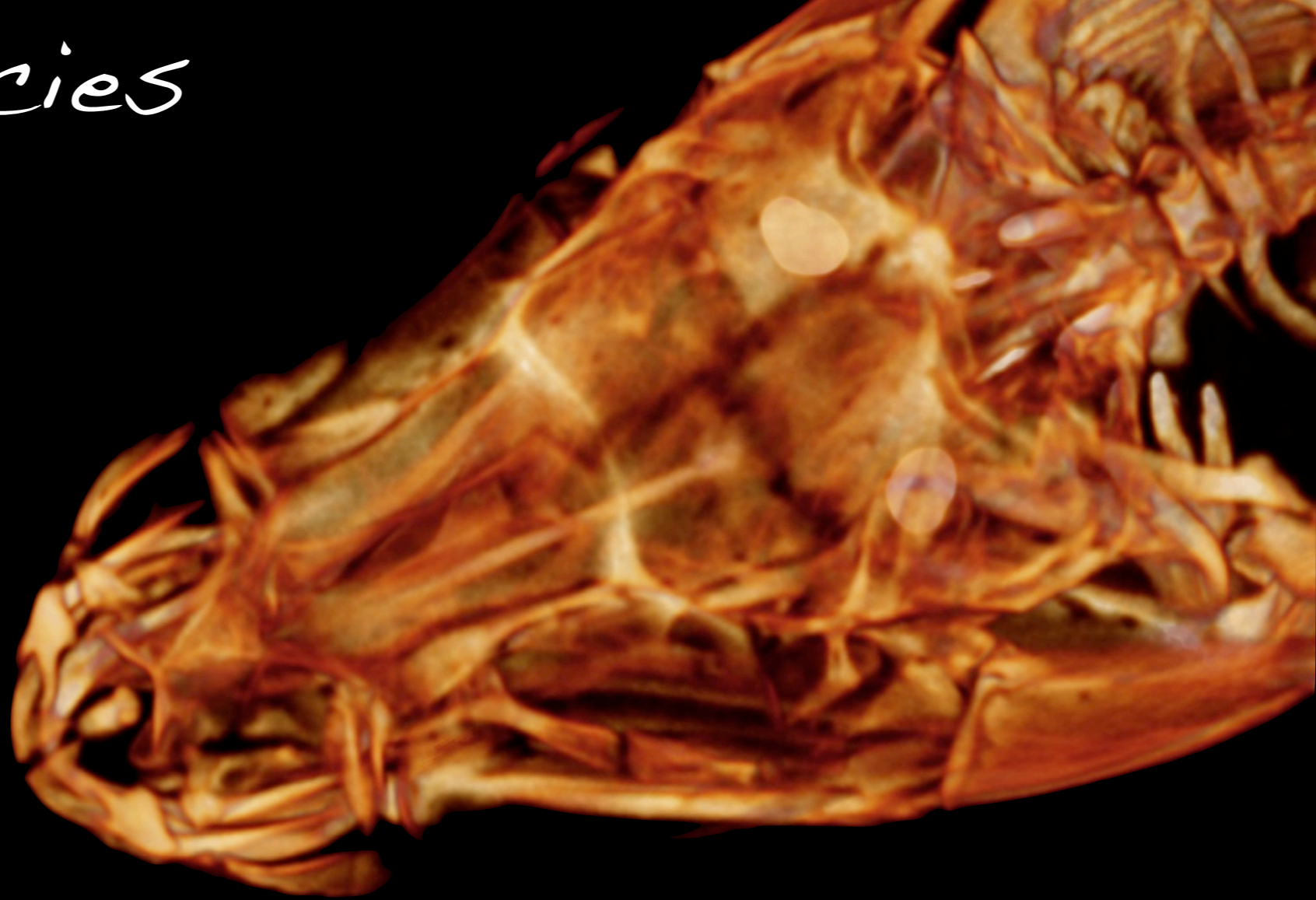
• 30 minutes - 12 hours

Serrasalmus medinae



Cyprinella lepida

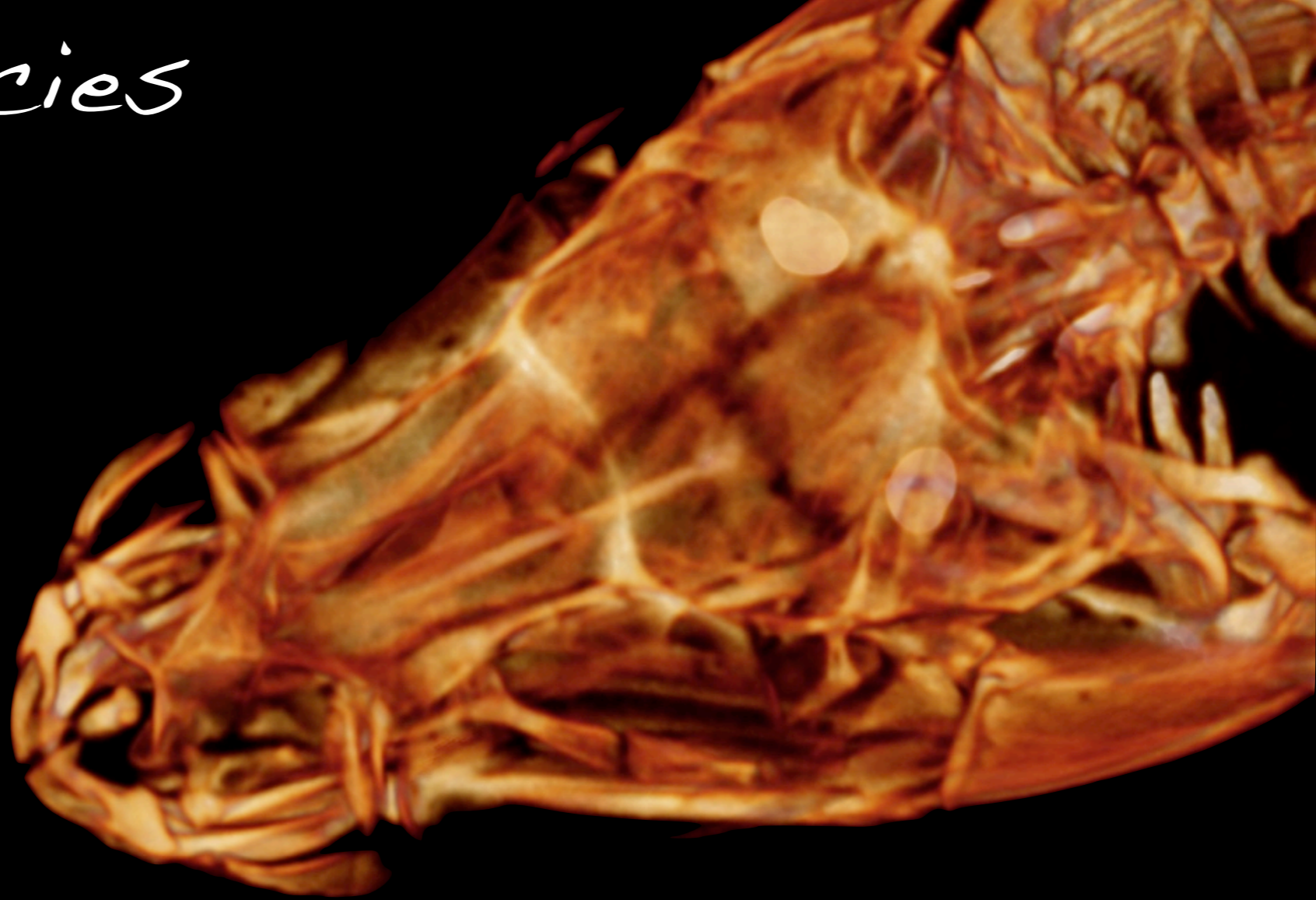
- ~33,000 species



Cyprinella lepida

- ~33,000 species

- ~45 years

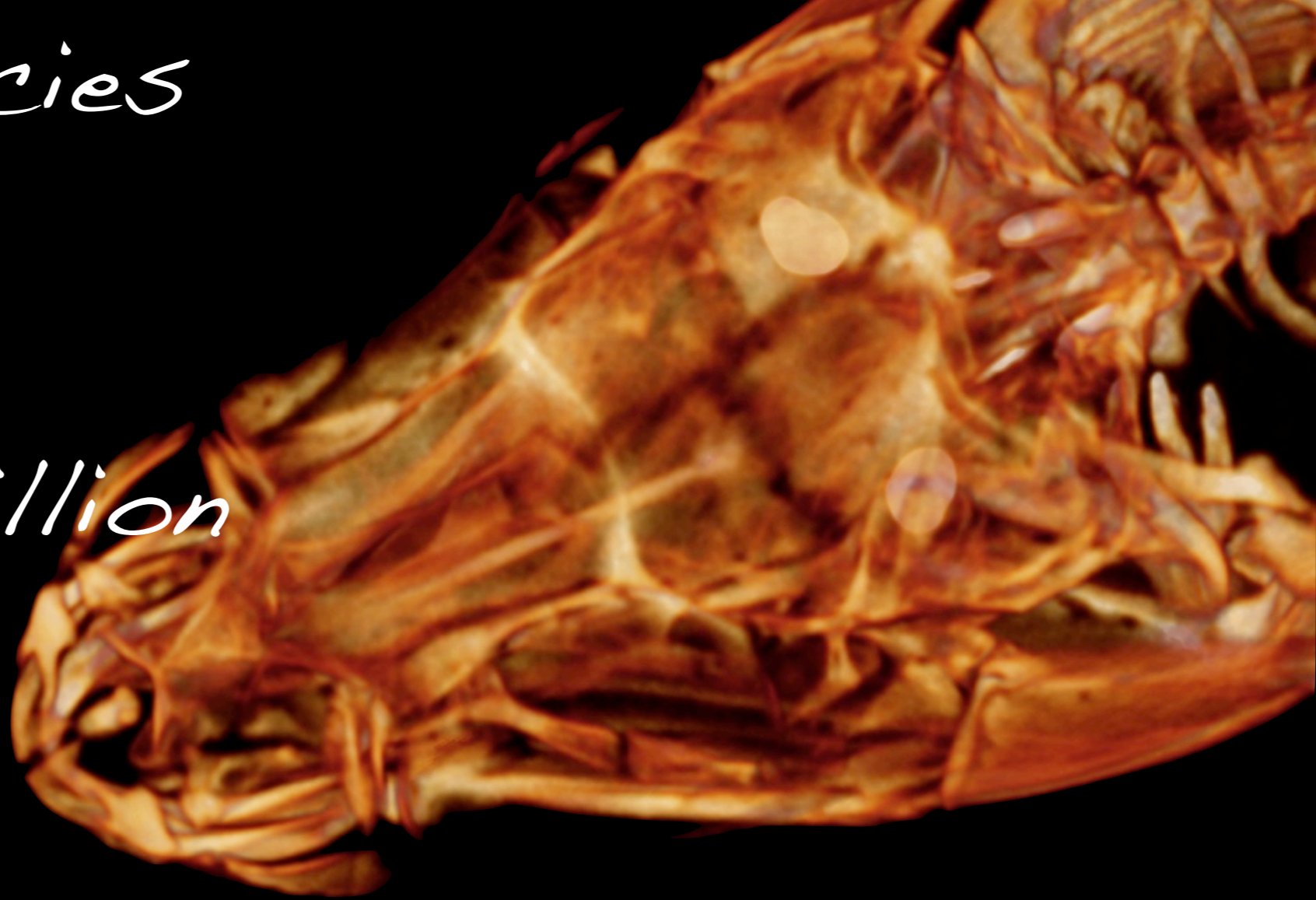


Cyprinella lepida

- ~33,000 species

- ~45 years

- ~\$3-300 million

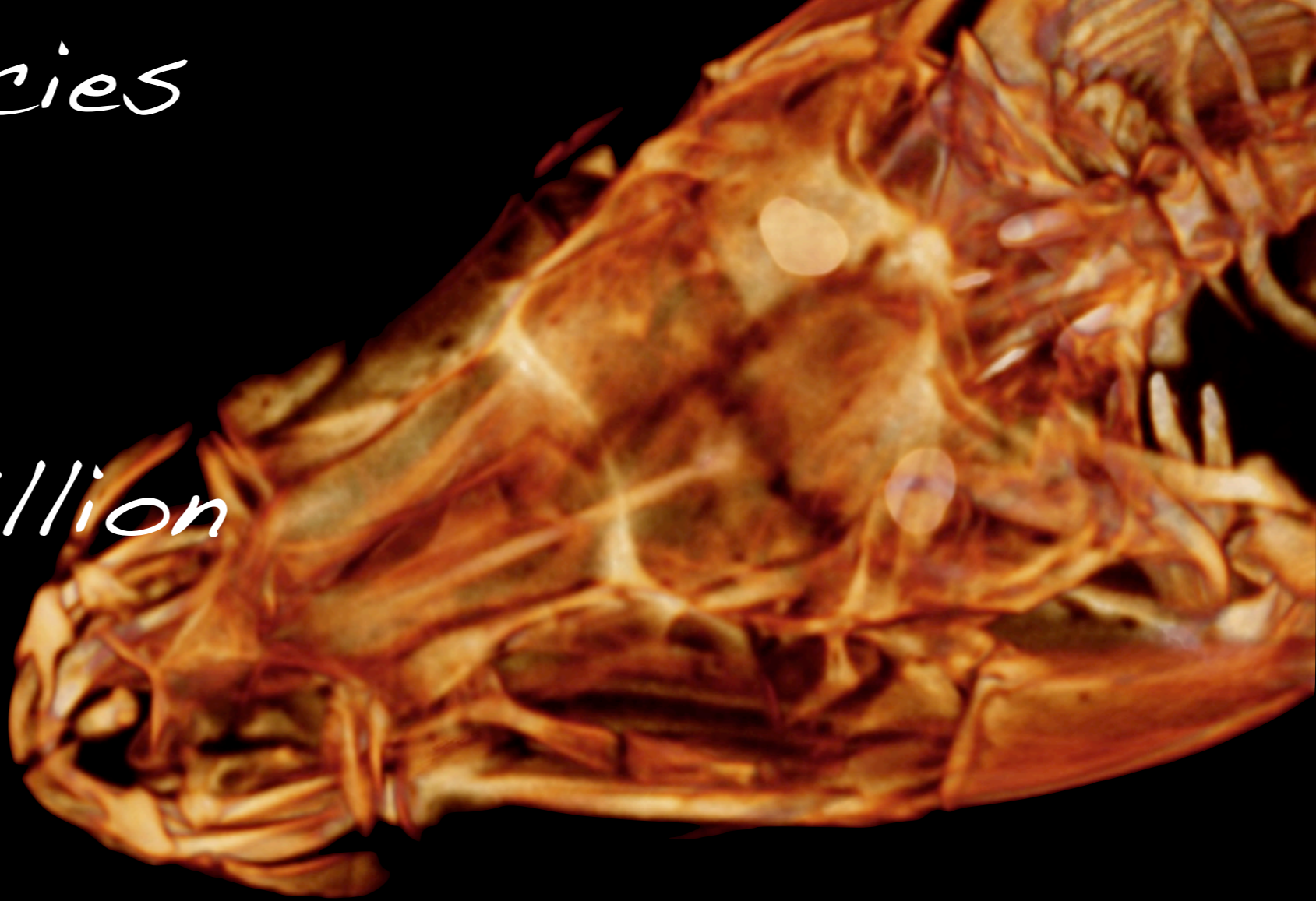


Cyprinella lepida

- ~33,000 species

- ~45 years

- ~ \$3-300 million



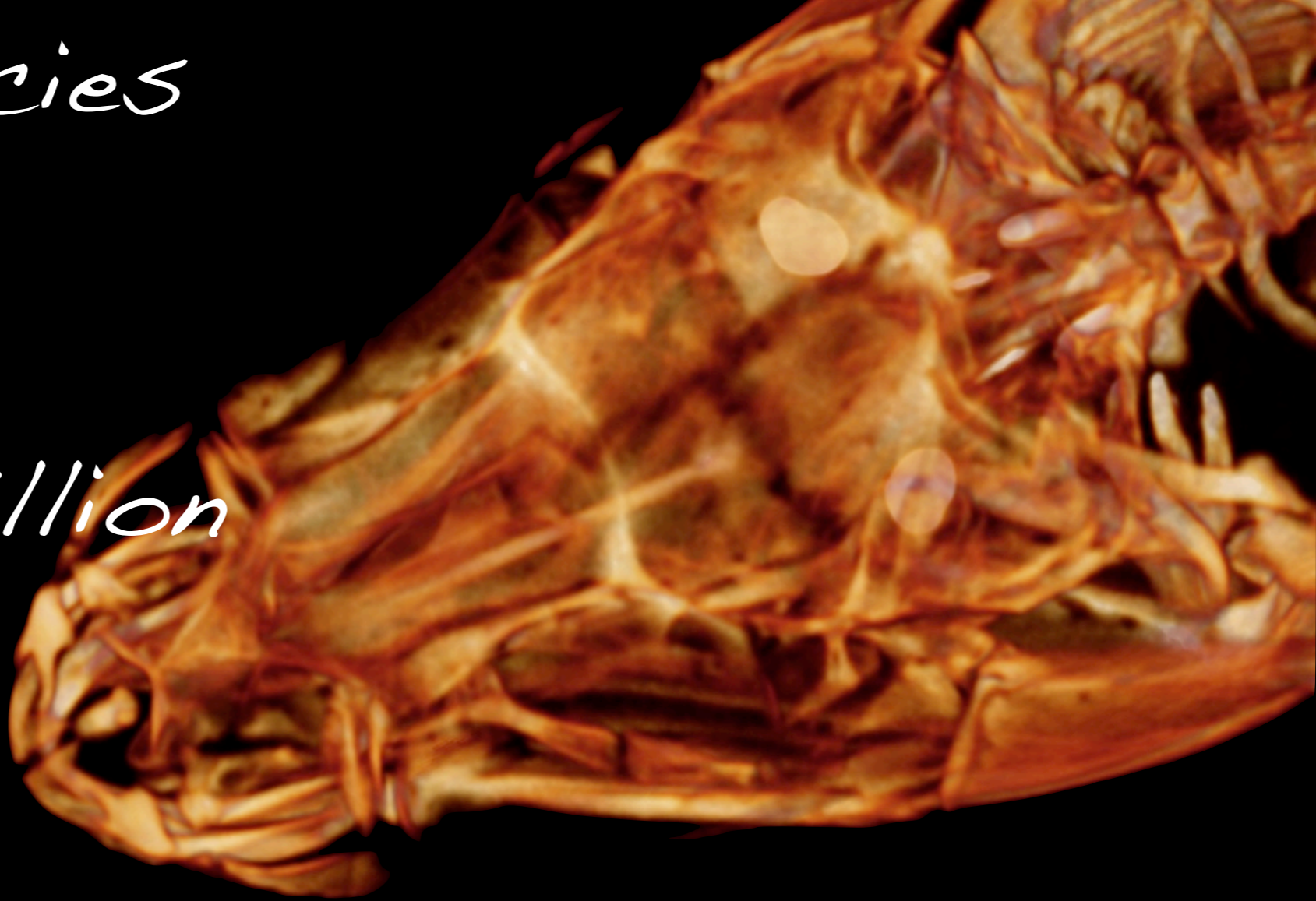
- scan fewer species

Cyprinella lepida

- ~33,000 species

- ~45 years

- ~ \$3-300 million



- scan fewer species

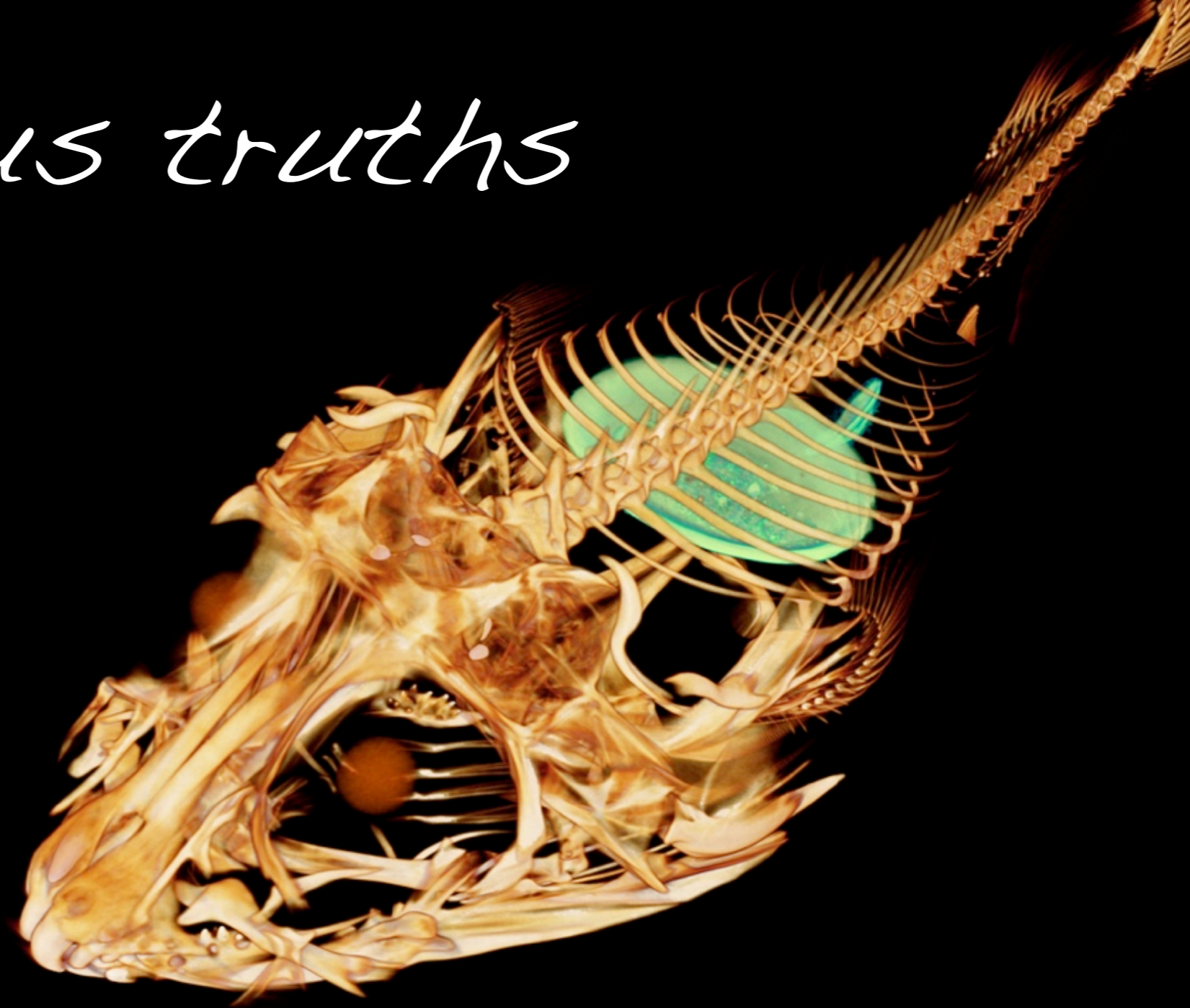
- scan faster

Cyprinella lepida

Karel F. Liem
BioImaging Center

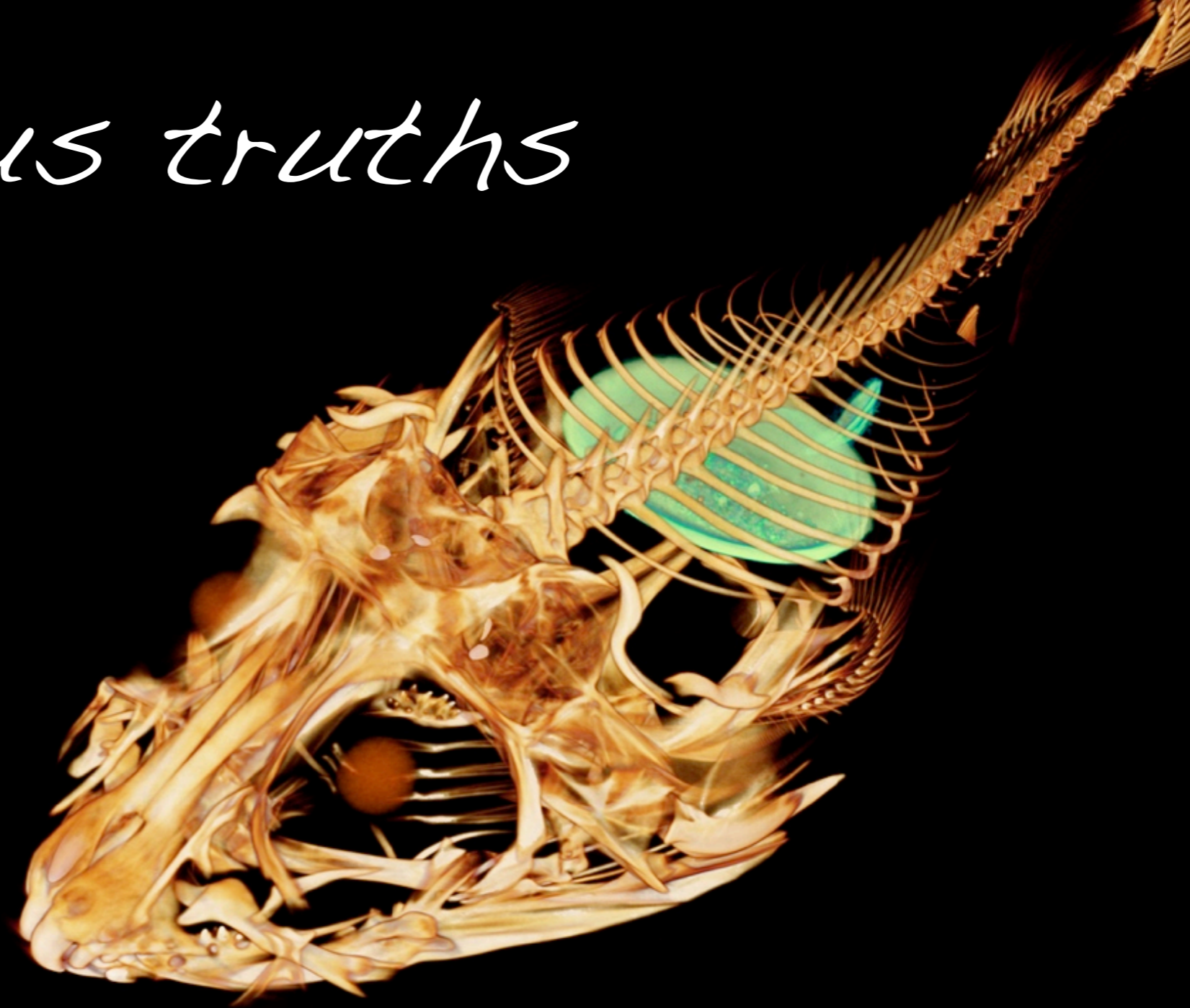


Two obvious truths



Chorisochismus dentax

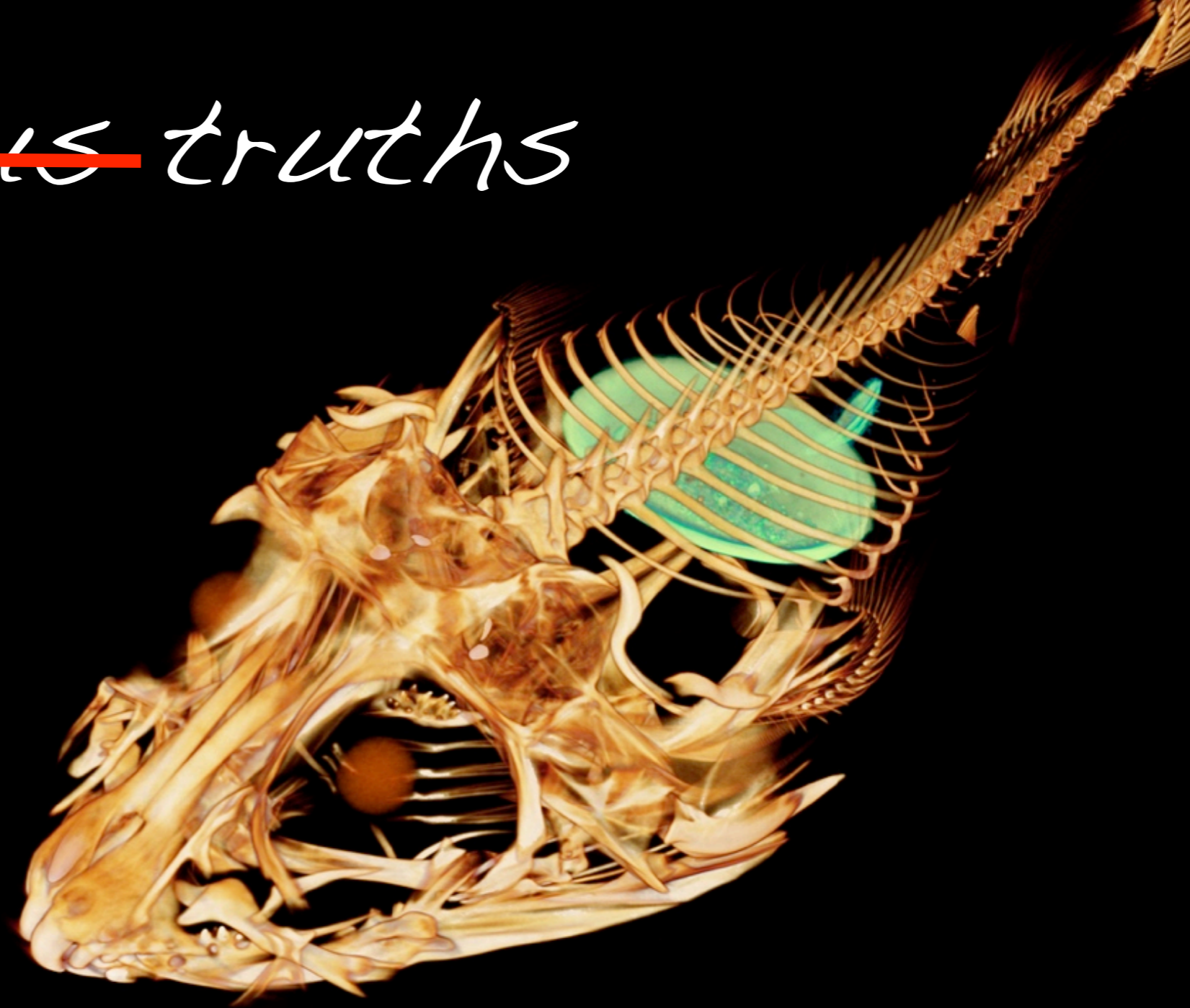
Two obvious truths



- Cylindrical interrogation volume

Chorisochismus dentax

Two ~~obvious~~ truths



- Cylindrical interrogation volume
- Don't want ALL the resolution

Chorisochismus dentax

How much resolution?



Cochliosepis spatula

How much resolution?



- Depends on purpose



Cochlioseps spatula

How much resolution?

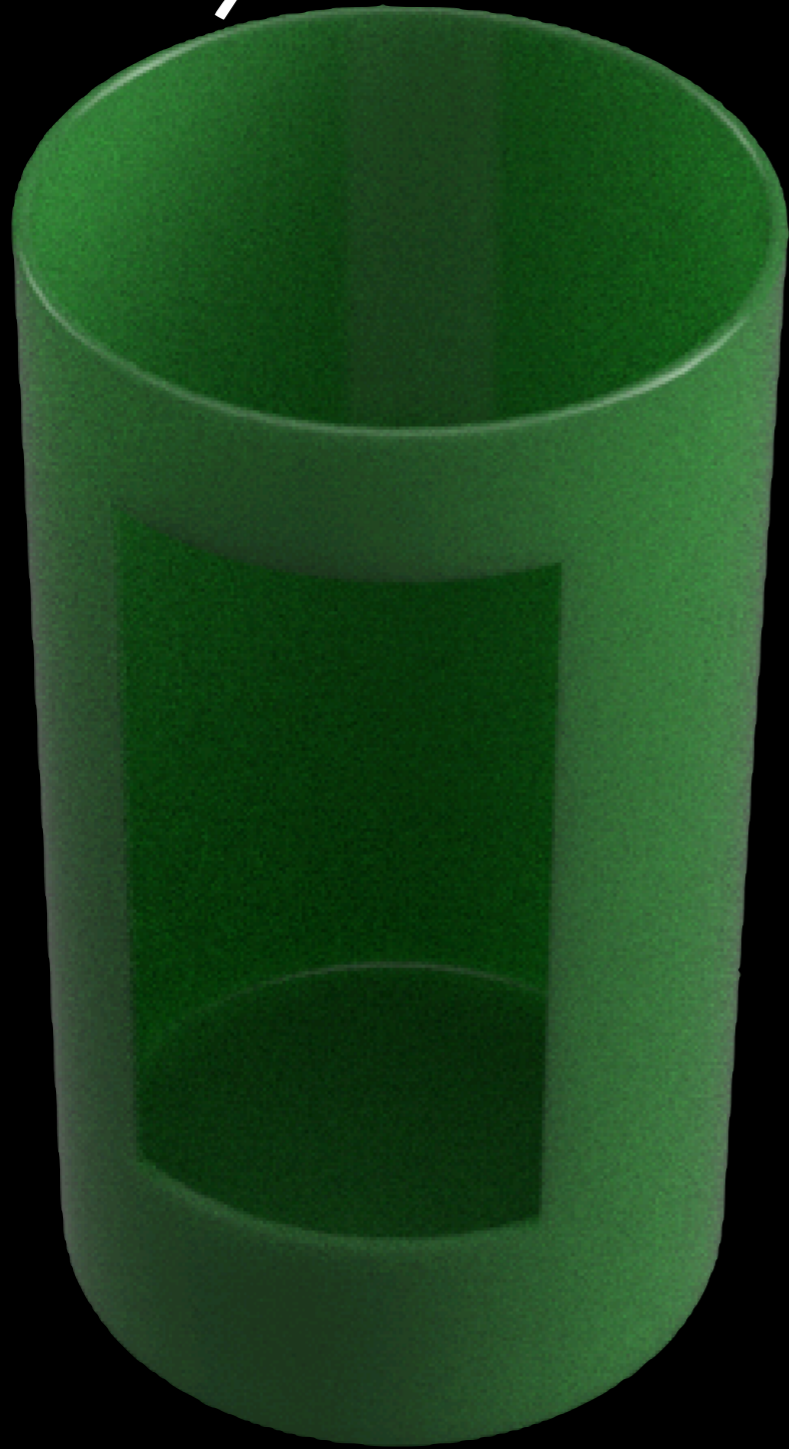


- Depends on purpose
- >250 slices across skull

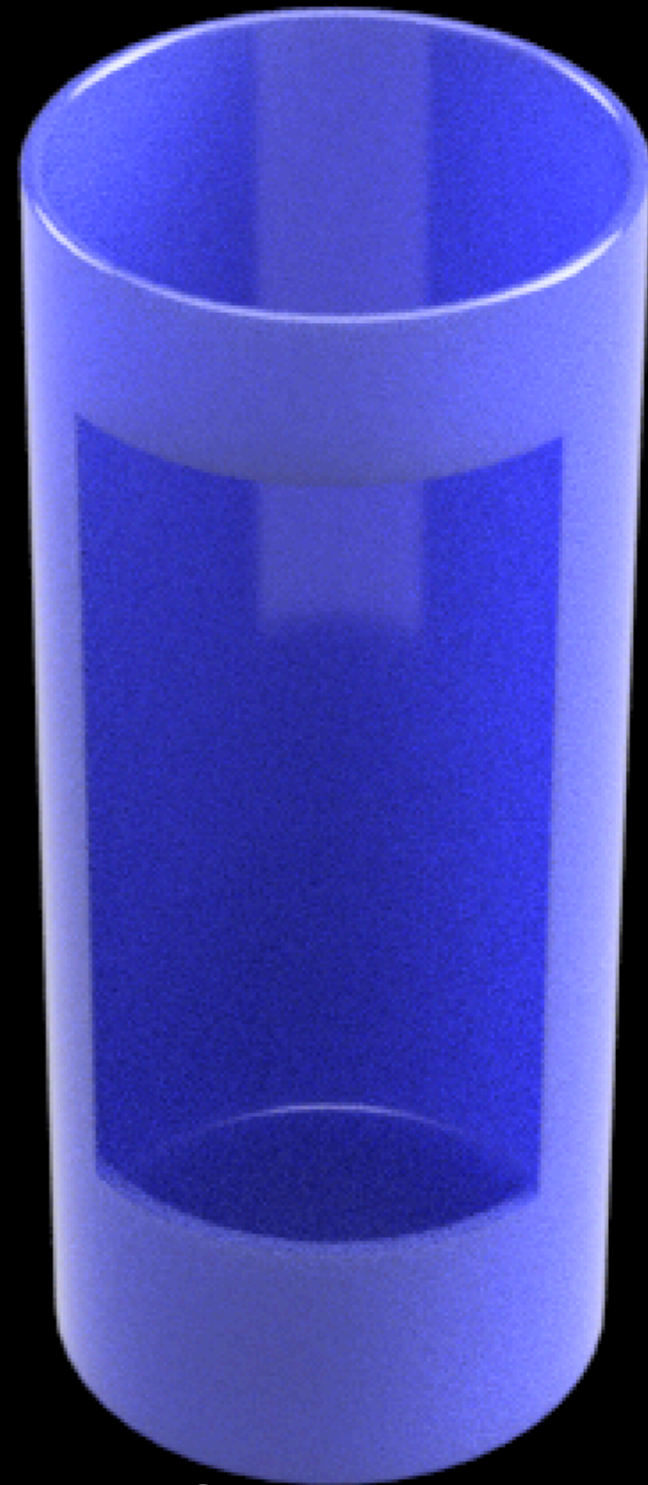


Cochliosepis spatula

Cylinders and resolution

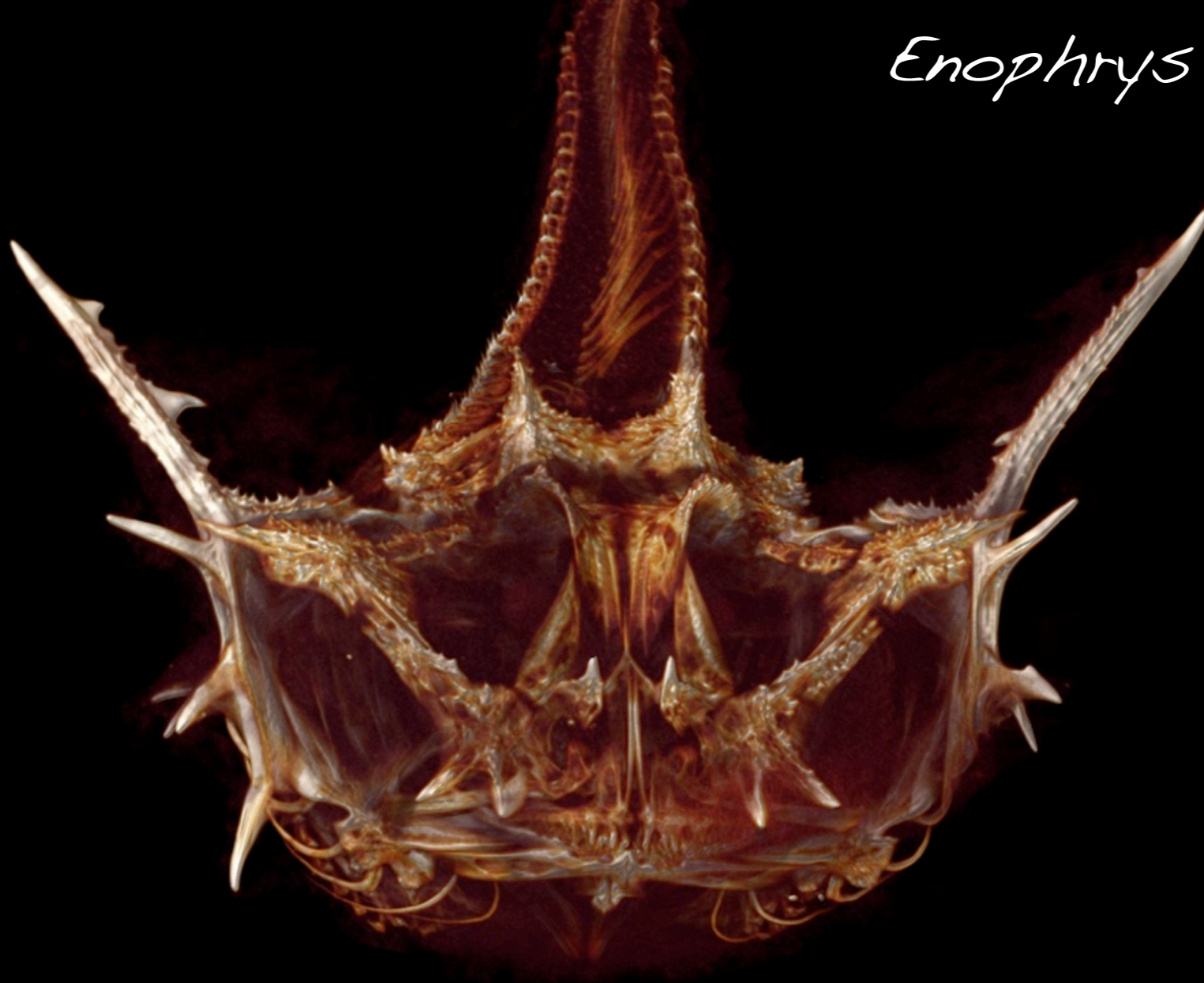


50 μm
20 slices/mm

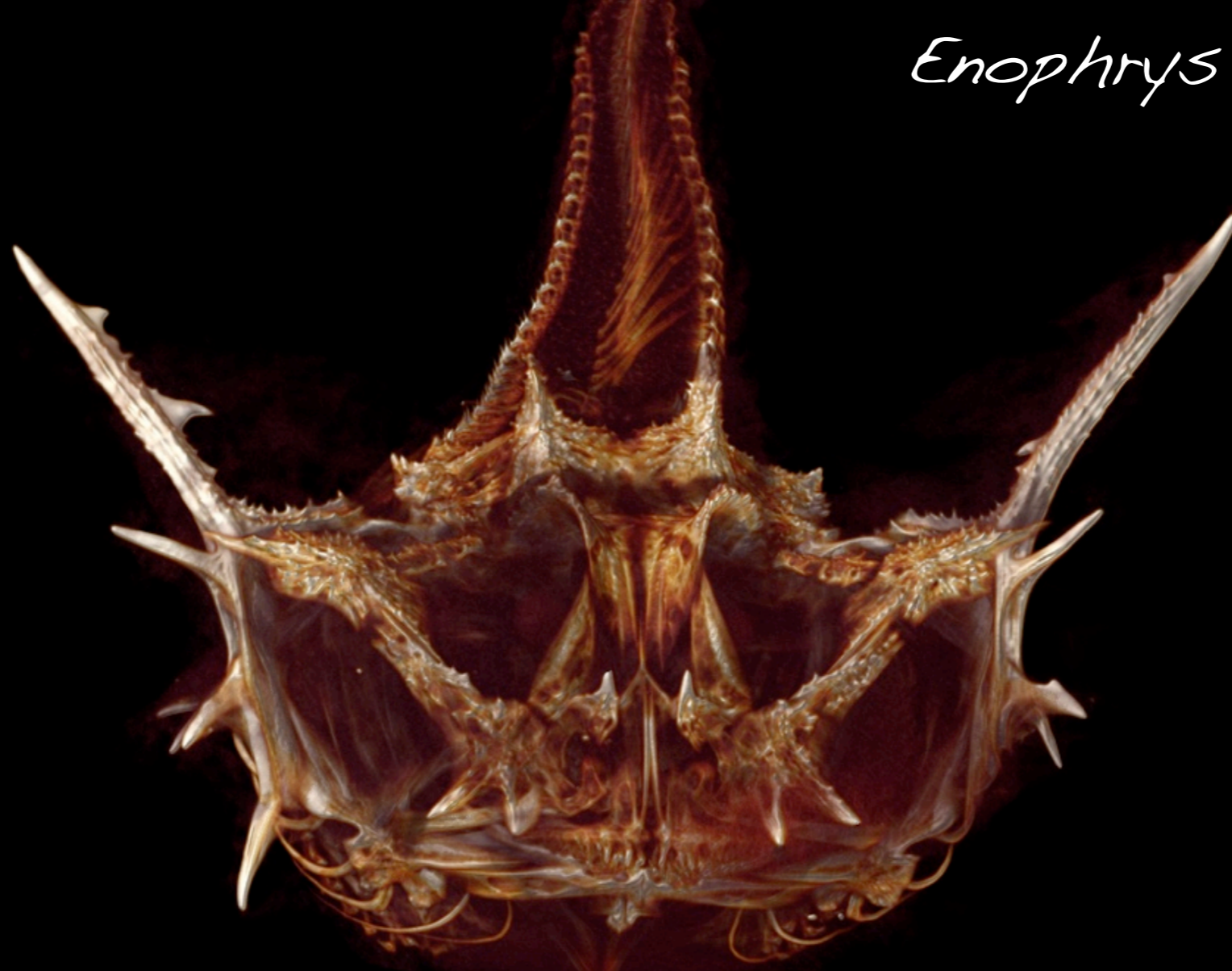


30 μm
33 slices/mm

Enophrys diceraus

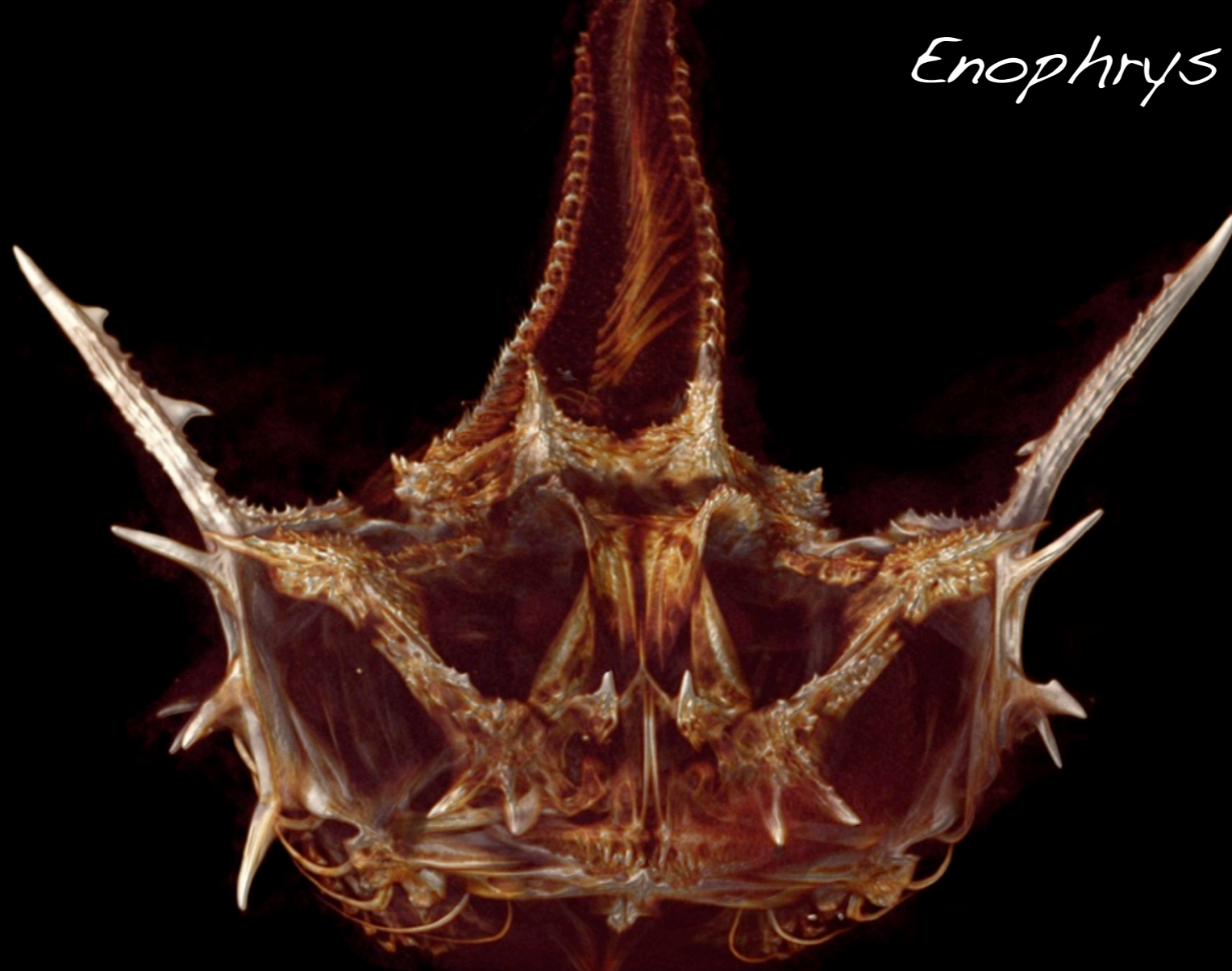


Enophrys diceraus



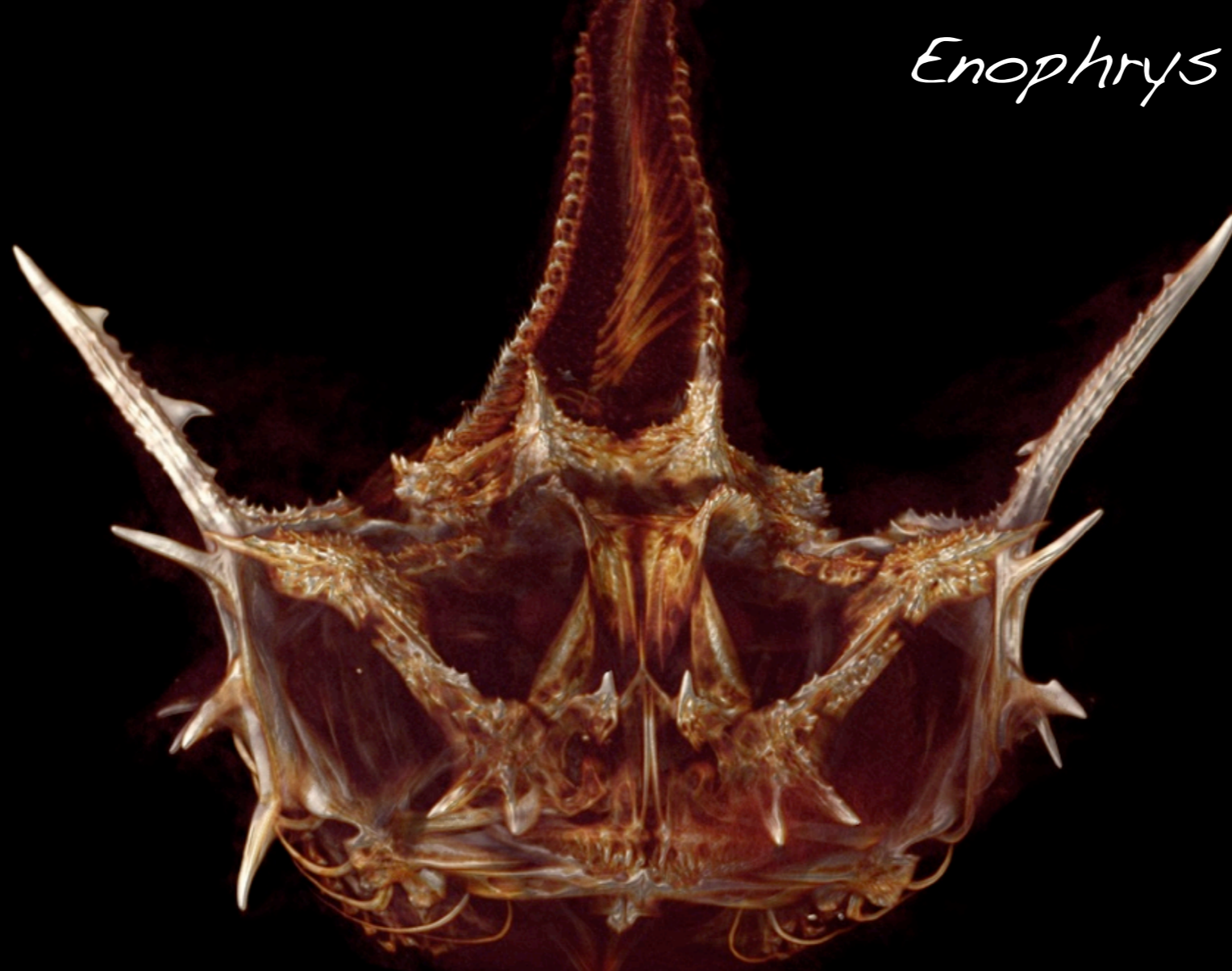
- Resolution depends on fish size

Enophrys diceraus



- Resolution depends on fish size
- Pack the cylinder

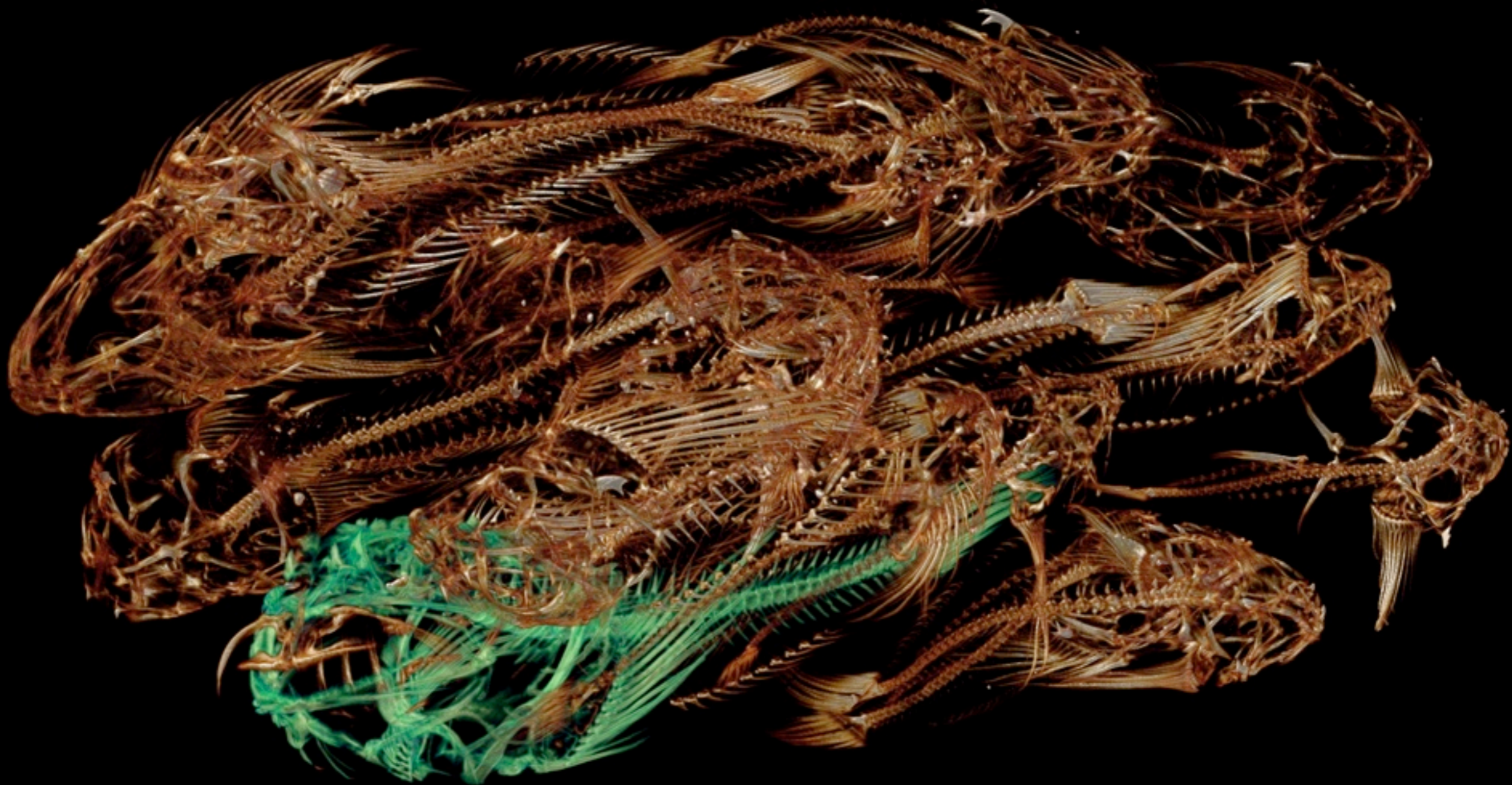
Enophrys dicerca

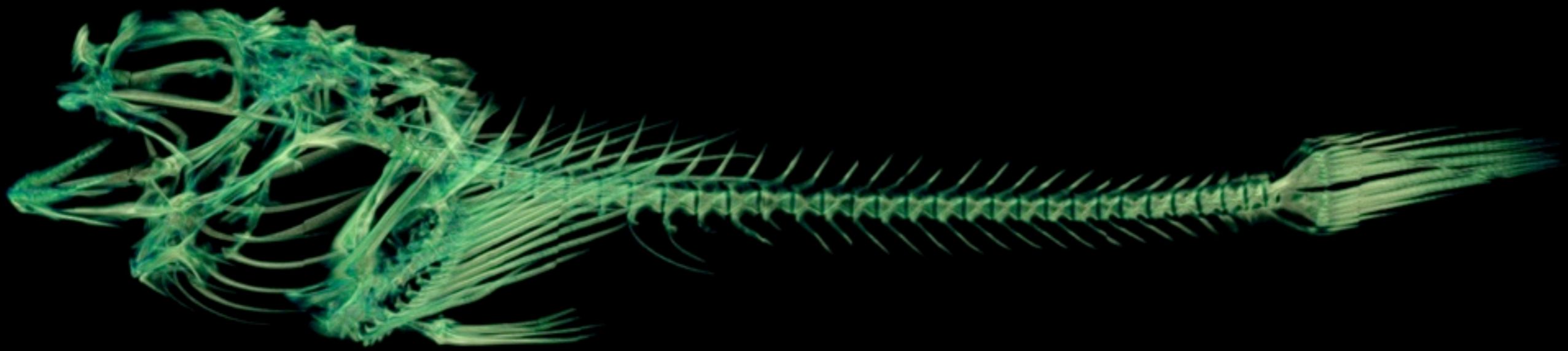


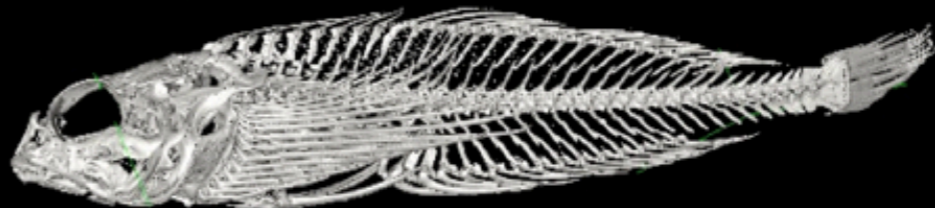
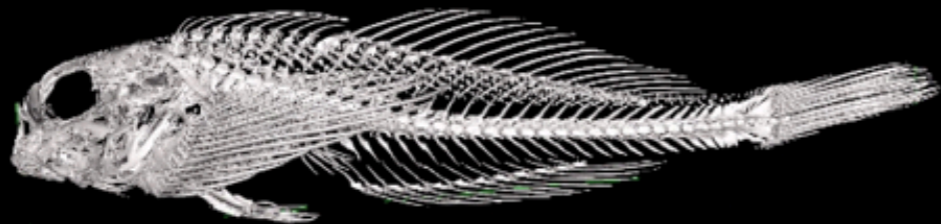
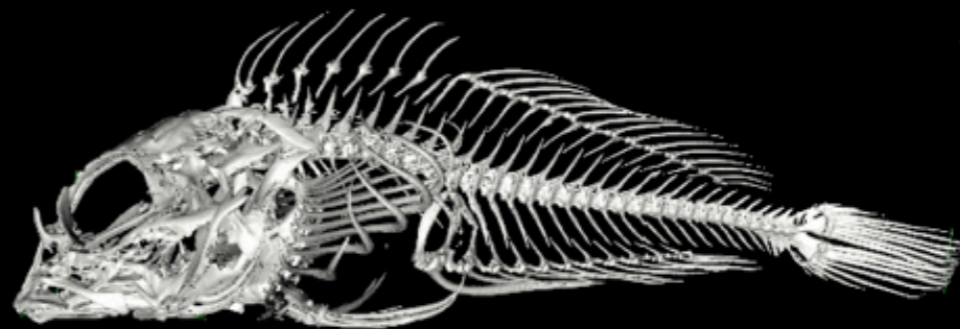
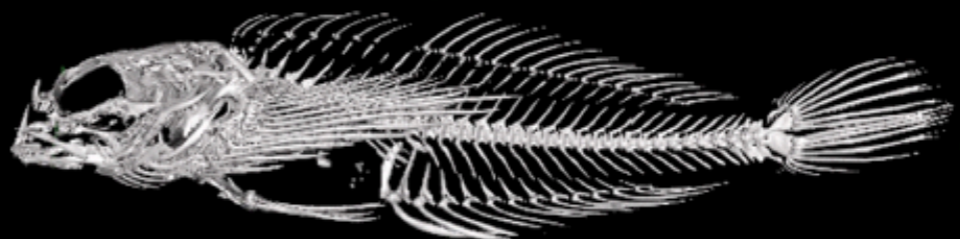
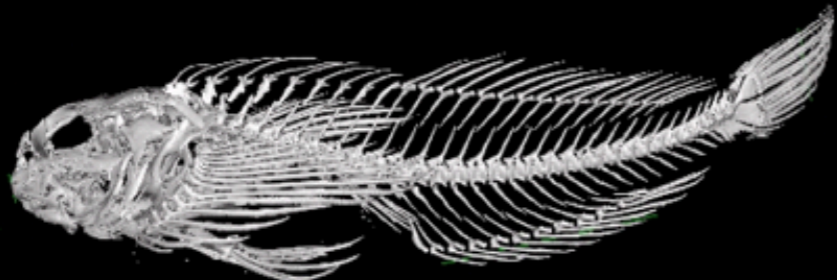
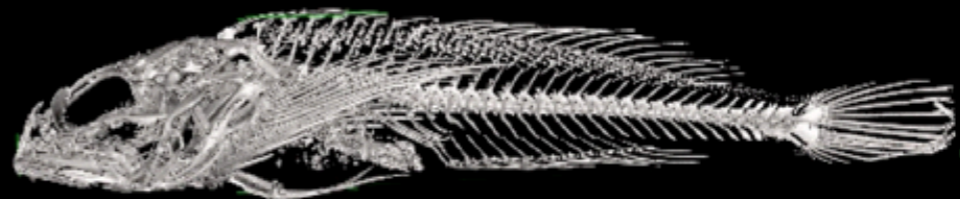
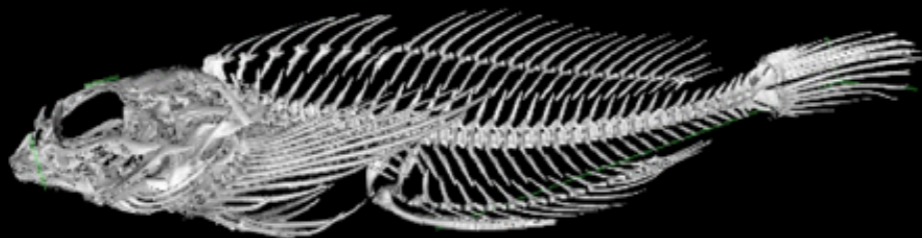
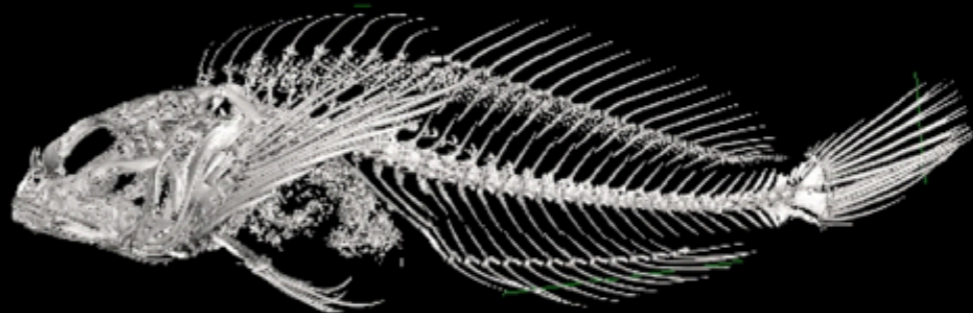
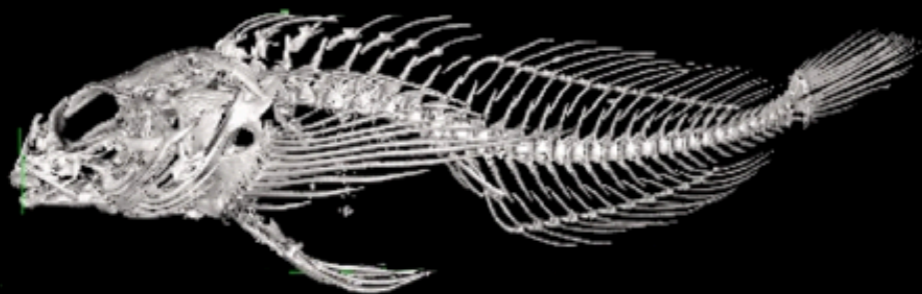
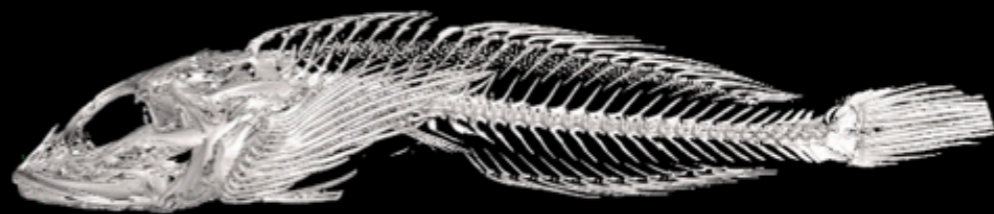
- Resolution depends on fish size
- Pack the cylinder
- 10-20 specimens/scan

The fish burrito











Hypsagonus quadricornis

• #ScanAllFish



Hypsagonus quadricornis

- #ScanAllFish

- 1991 species



Hypsagonus quadricornis

- #ScanAllFish
- 1991 species
- 3094 specimens



Hypsagonus quadricornis

- #ScanAllFish
- 1991 species
- 3094 specimens
- 109 collections



Hypsagonus quadricornis

Strategy

Pallasina barbata



Strategy

Pallasina barbata



- Attract stakeholders

Strategy

Pallasina barbata



- Attract stakeholders
- Viral training

Strategy

Pallasina barbata



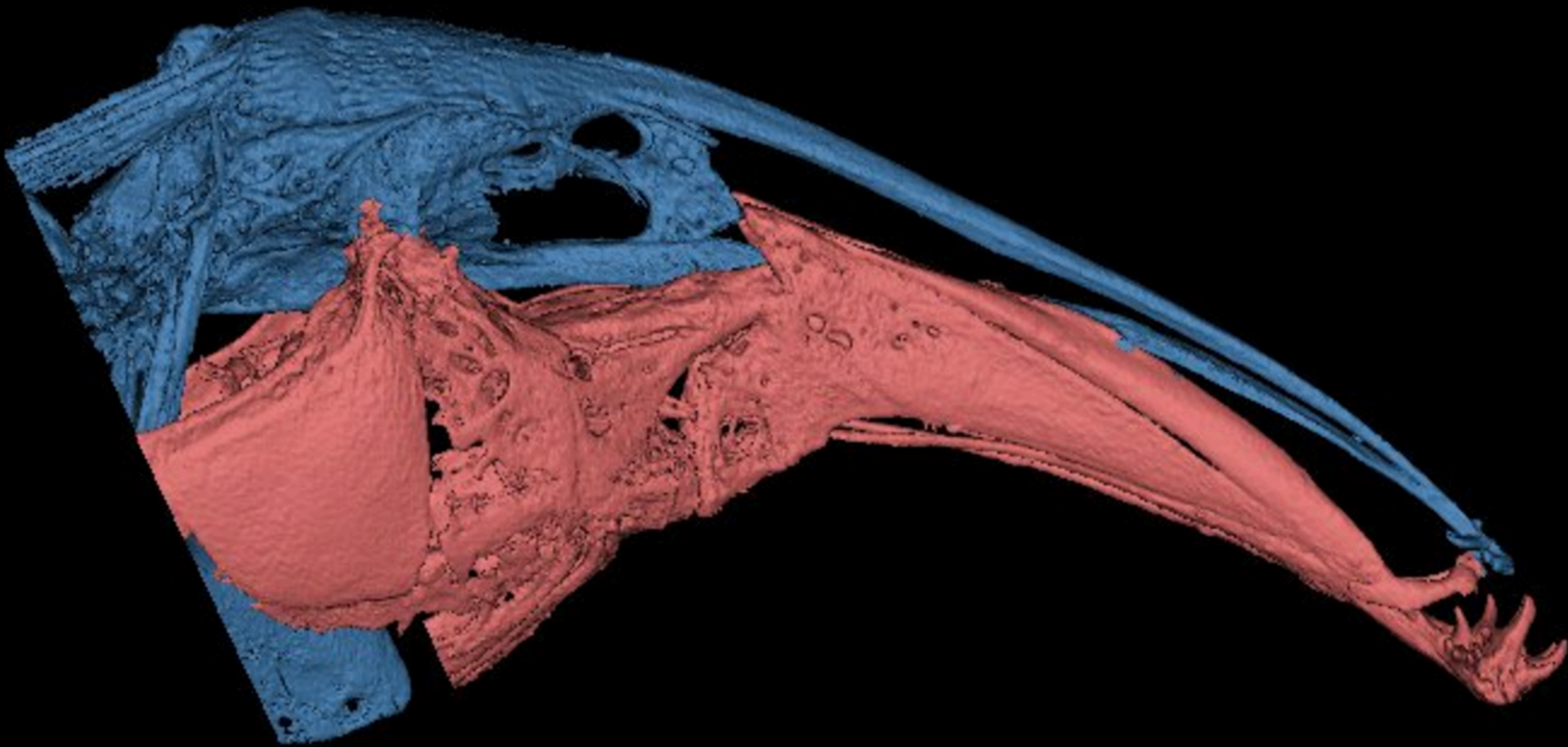
- Attract stakeholders
- Viral training
- Funding for bottlenecks

Strategy

Pallasina barbata

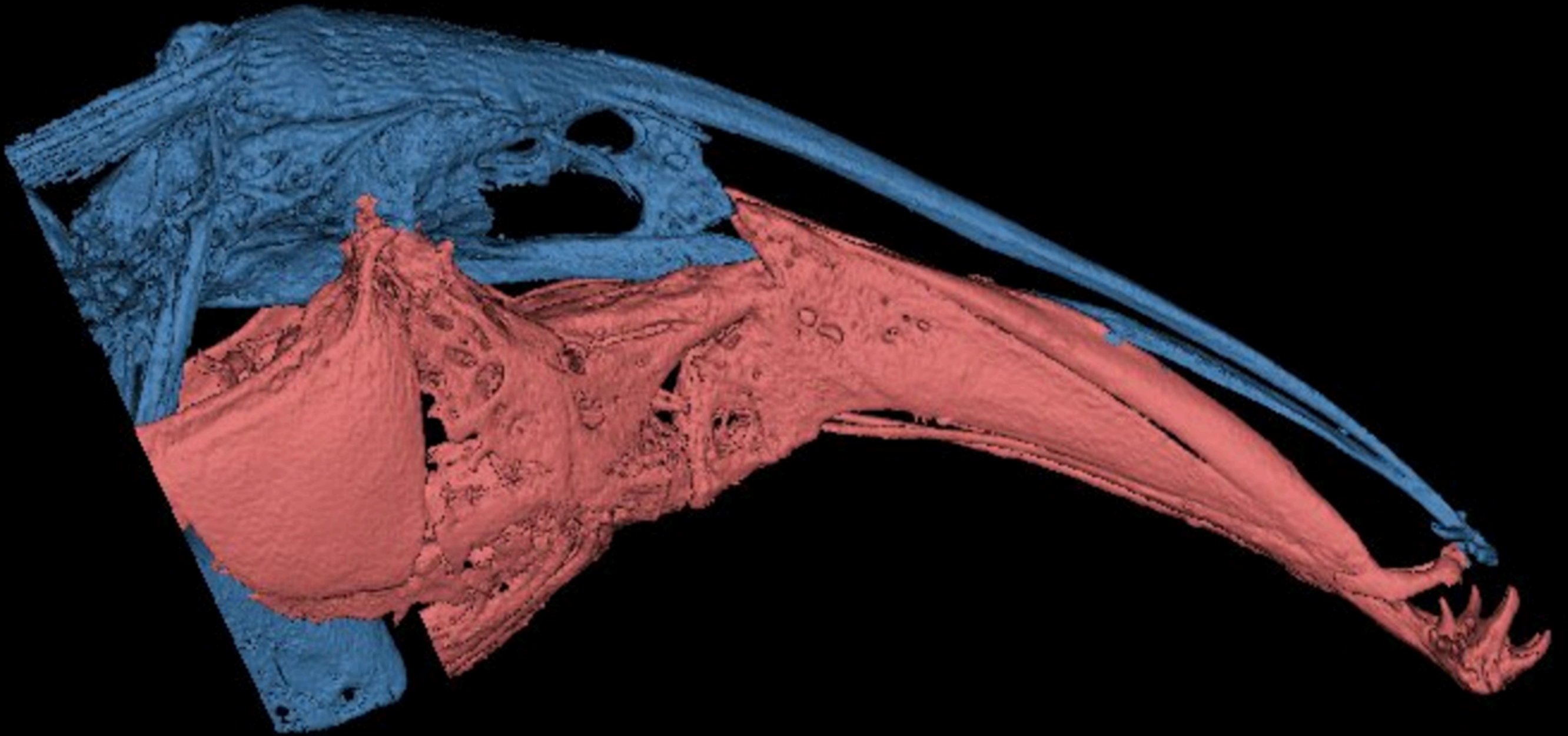


- Attract stakeholders
- Viral training
- Funding for bottlenecks
- Funding for access



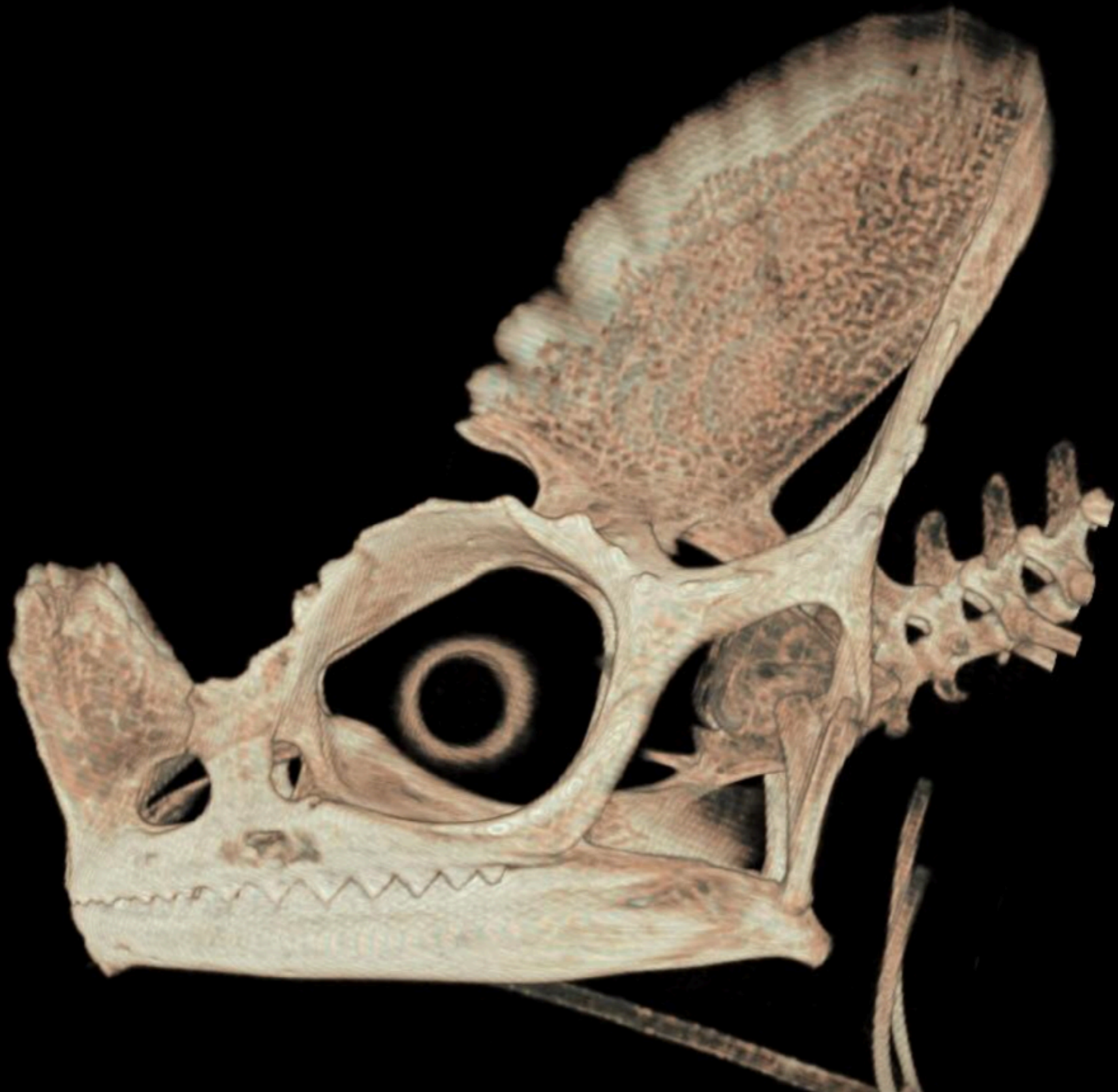
Sternarchorhynchus hagedornae

- Kory Evan-Jackson (LSU)

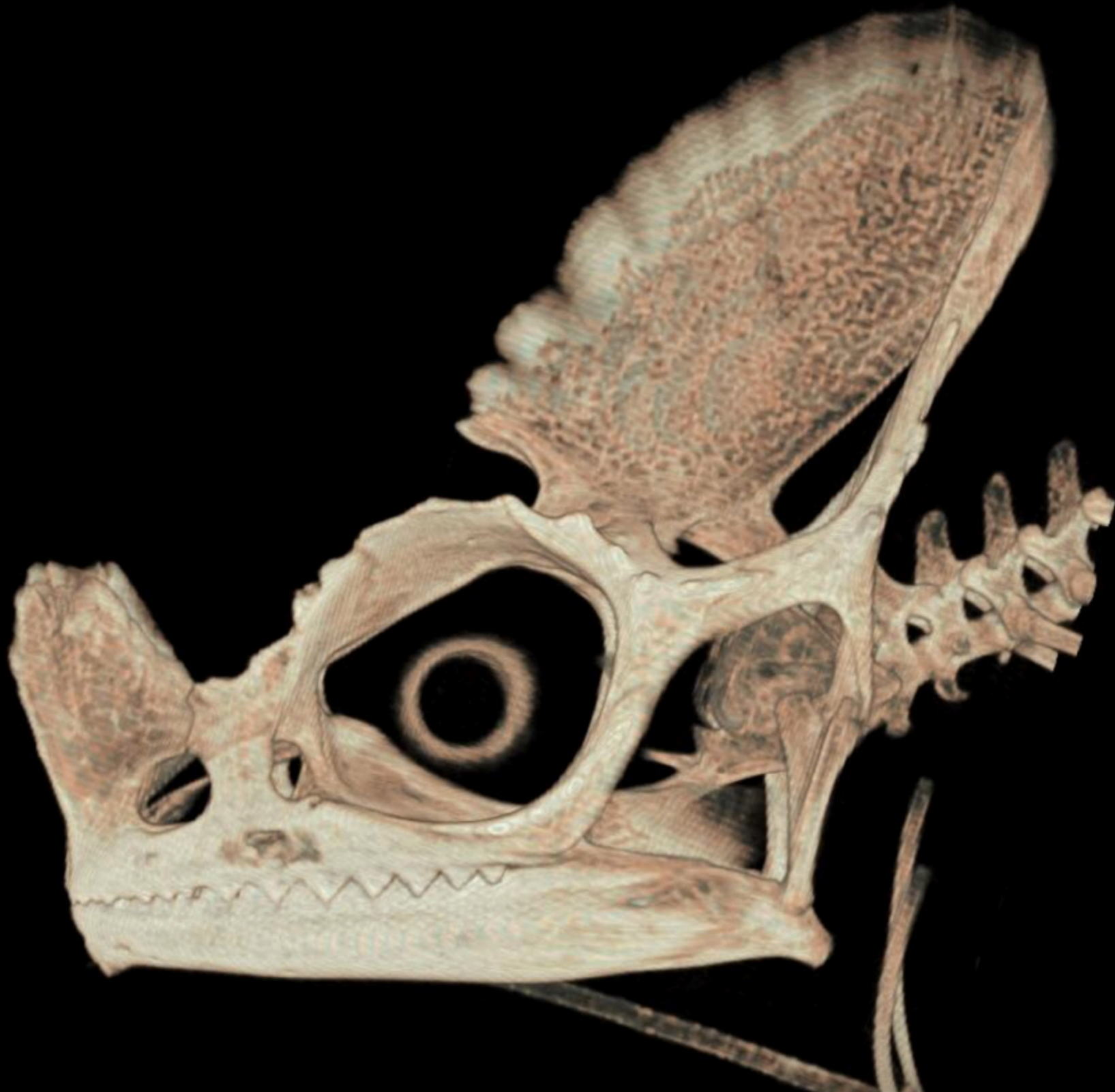


Sternarchorhynchus hagedornae

- Kory Evan-Jackson (LSU)
- Gymnotiform fishes
- 8 days in Nov 2016
- 77 species
- 238 specimens
- 1 paper submitted

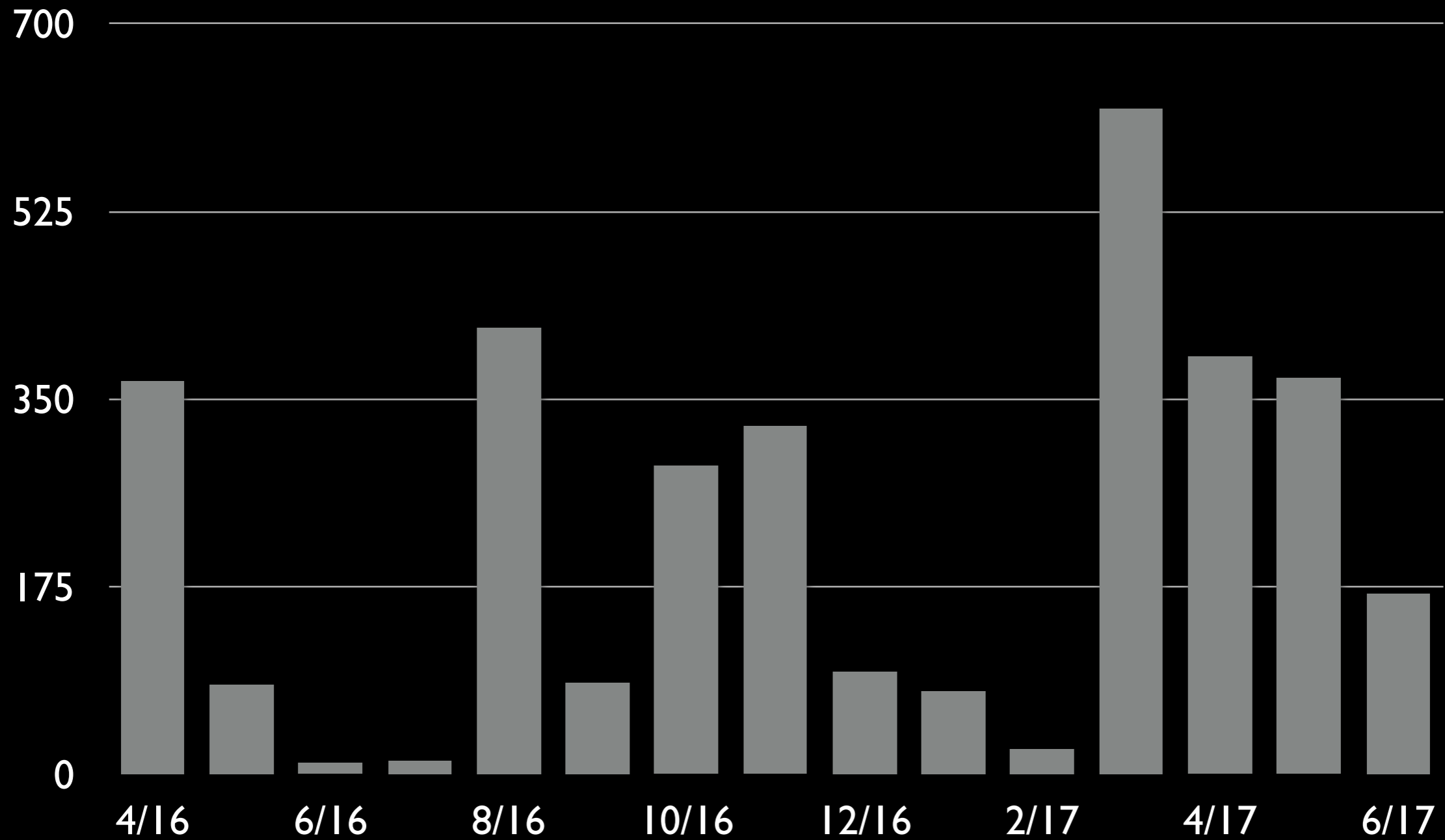


• Chris Anderson

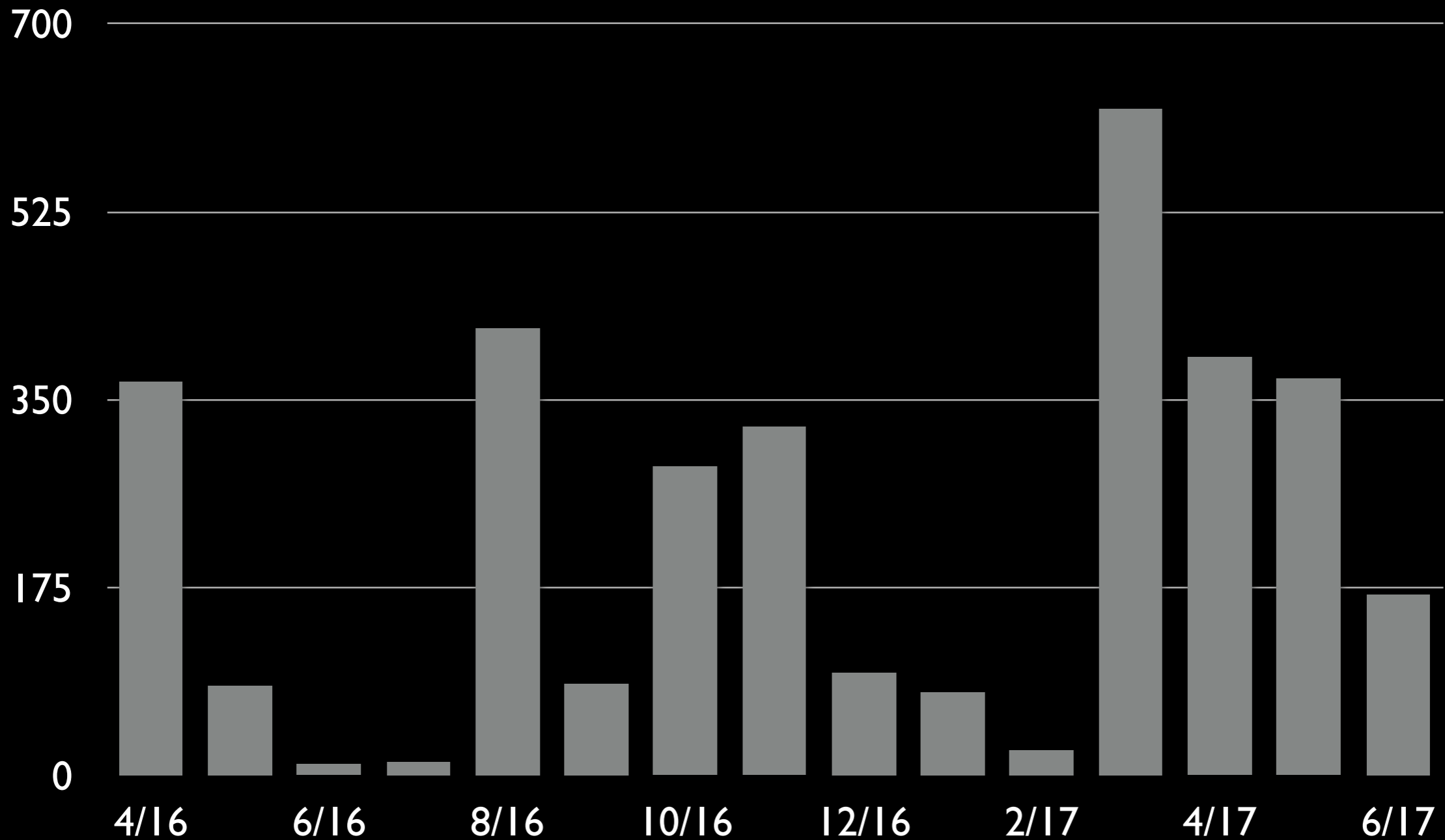


- Chris Anderson
- Chameleons
- 6 days in Apr 2017
- 97 species
- 138 specimens
- Loan refused

Unfunded Scanning Rate



Unfunded Scanning Rate



211 specimens a month

Space - the terrifying frontier

Space - the terrifying frontier

- 29 TB for 3096 specimens

Space - the terrifying frontier

- 29 TB for 3096 specimens
- 9.3 GB per specimen

Space - the terrifying frontier

- 29 TB for 3096 specimens
- 9.3 GB per specimen
- 2 TB per month

Space - the terrifying frontier

- 29 TB for 3096 specimens
- 9.3 GB per specimen
- 2 TB per month
- 300 TB for all fishes

Space - the terrifying frontier

- 29 TB for 3096 specimens
- 9.3 GB per specimen
- 2 TB per month
- 300 TB for all fishes

What should we save?

Open Access - Copyrights

Access leads to innovation

Open Access - Copyrights

- All data are available #OA

Access leads to innovation

Open Access - Copyrights

- All data are available #OA
- Data are available CC-BY

Access leads to innovation

Open Access - Copyrights

- All data are available #OA
- Data are available CC-BY
- Open Science Framework

Access leads to innovation

Open Access - Copyrights

- All data are available #OA
- Data are available CC-BY
- Open Science Framework
- MorphoSource

Access leads to innovation

Home

CT-Collection



CT-Collection



Art



Information

Internal (Password)

[ZI](#)

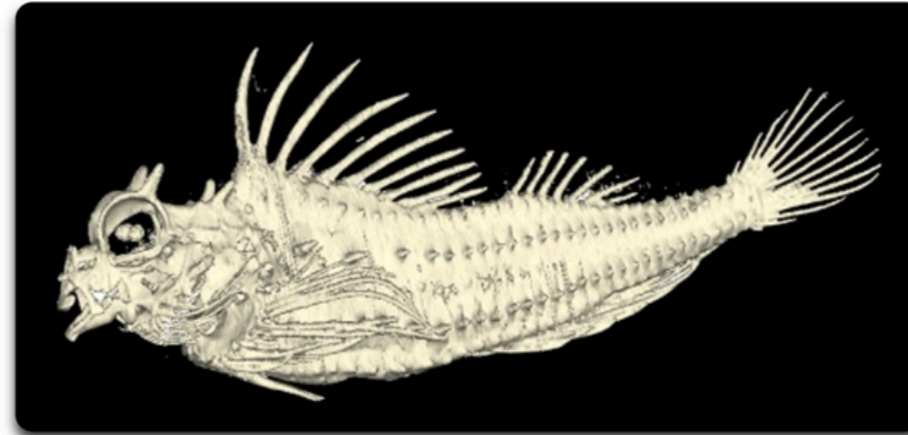
[ScanAllFish](#)

Expand All
Collapse All

- Chondrichthyes (Cartilaginous fi
- Actinopterygii (Ray finnes fishes
- Mammalia (Mammals)
- Sauropsida

CT-Collection

A portal to CT Scans of Vertebrates
Featuring Adam Summers World of Fishes



Adam Summers from the Friday Harbor Labs at the University of Washington has made it possible that a large number of CT scans of primarily fishes is available for the scientific community. The dissemination of such material is difficult for two reasons. First, producers often reserve copyrights to their material. Second, datasets are frequently in the range of GigaBytes and to view these data requires download times of hours and special programs and conversion before such datasets can be inspected.

Often however, downsampled versions are sufficient and they allow direct inspection in a browser.

- Michael Hoffman
- Automated surface renders
- Rotatable + printable



- oVert - 'all' the vertebrates



- oVert - 'all' the vertebrates
- Dave Blackburn at UF



- oVert - 'all' the vertebrates
- Dave Blackburn at UF
- 15 collections





Stephanie Crofts



Joe Bizzarro



Petra Ditsche



Bob Rubin



Ashley Peterson



Misty Paig-Tran



Matt Kolmann



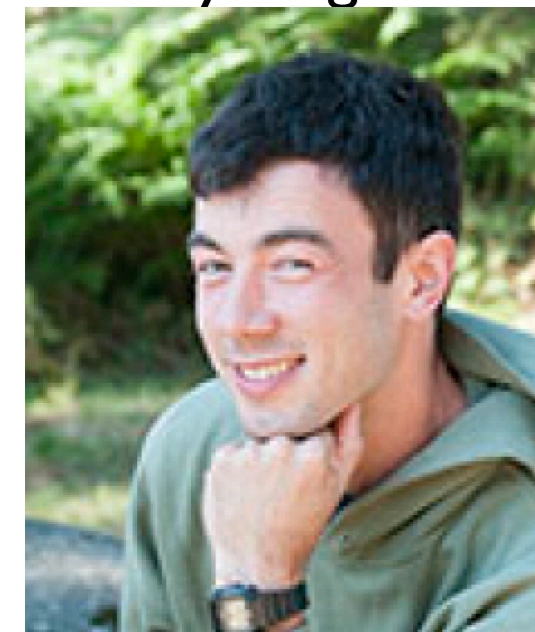
Cheryl Wilga



Thomas Kleinteich



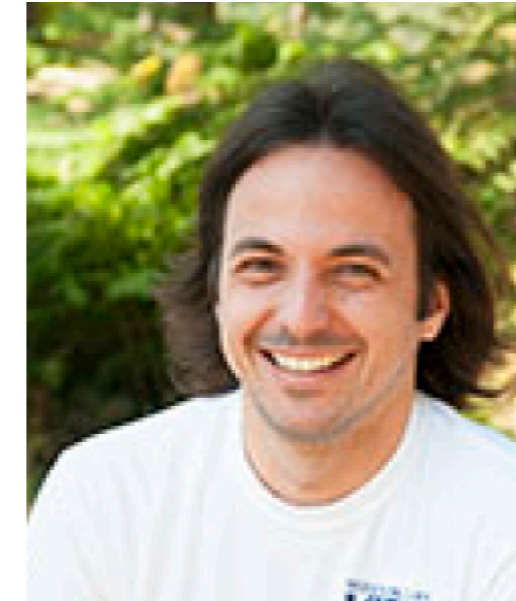
Marianne Porter



Thaddaeus Buser



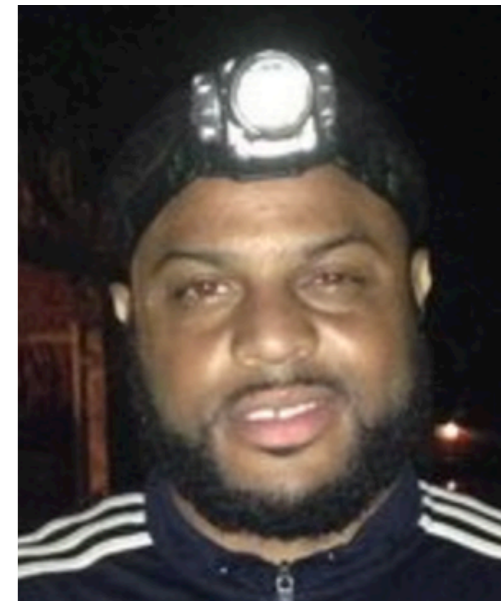
Cassandra Donatelli



Diego Vaz



Alice Gibb



Kory Evans-Jackson



Stephanie Crofts



Joe Bizzarro



Petra Ditsche



Bob Rubin



Ashley Peterson



Misty Paig-



is Kleinteich

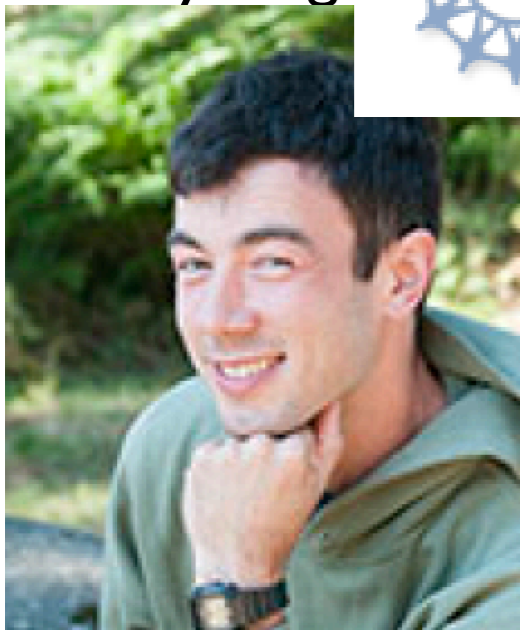


Marianne Porter

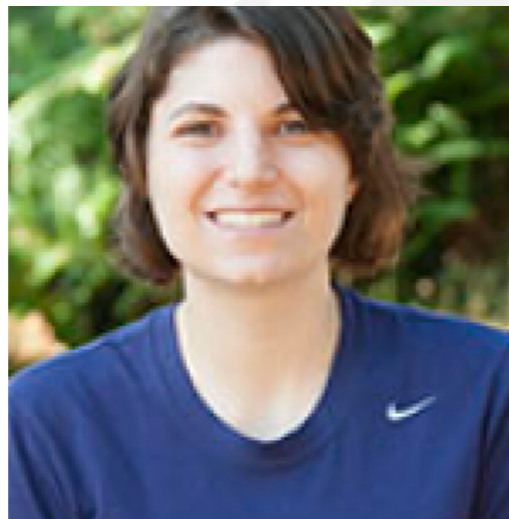


National Science Foundation

WHERE DISCOVERIES BEGIN



Thaddaeus Buser



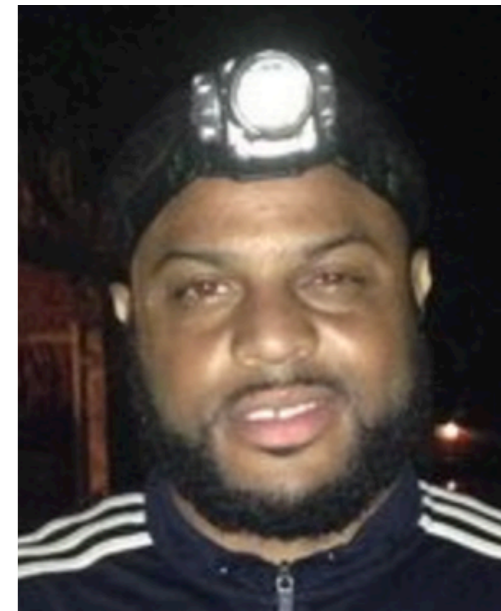
Cassandra Donatelli



Diego Vaz



Alice Gibb



Kory Evans-Jackson

Thanks...



Ellie



Abel



Sharalyn