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"3D Imaging and Innovative Approaches in Biosystematics"
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Dr. Brian Metscher
Senior Scientist
Department of
Theoretical Biology

universität wien

brian.metscher@univie.ac.at

nhm

BIG4 Biosystematics, Informatics, Genomics

universität wien

MicroCT gives an inside view

Orcula dolium
Terrestrial gastropod
SkyScan 1174,
7.7 µm voxel size.

Multi-scale imaging, non-destructive

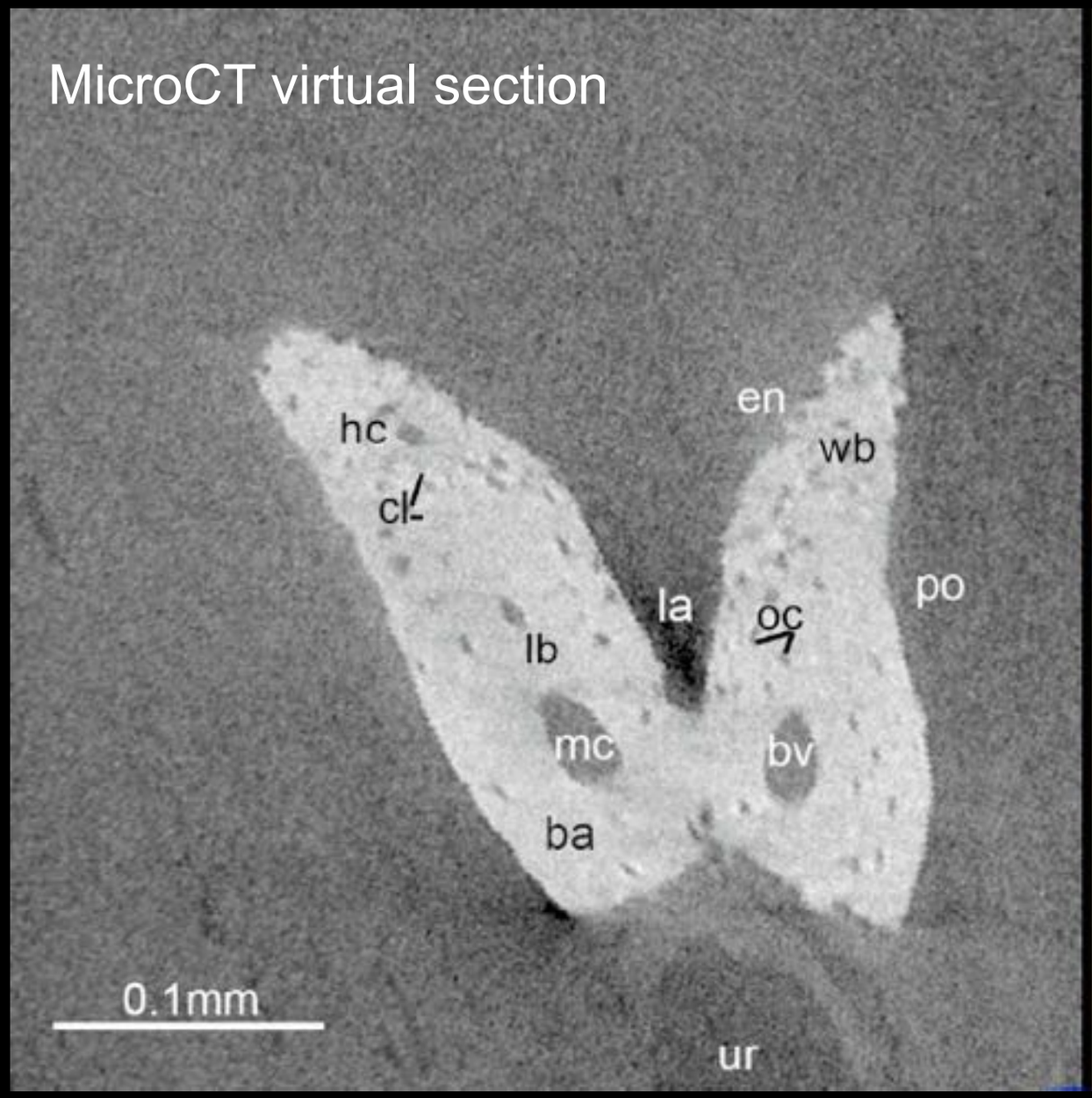
SkyScan 1174

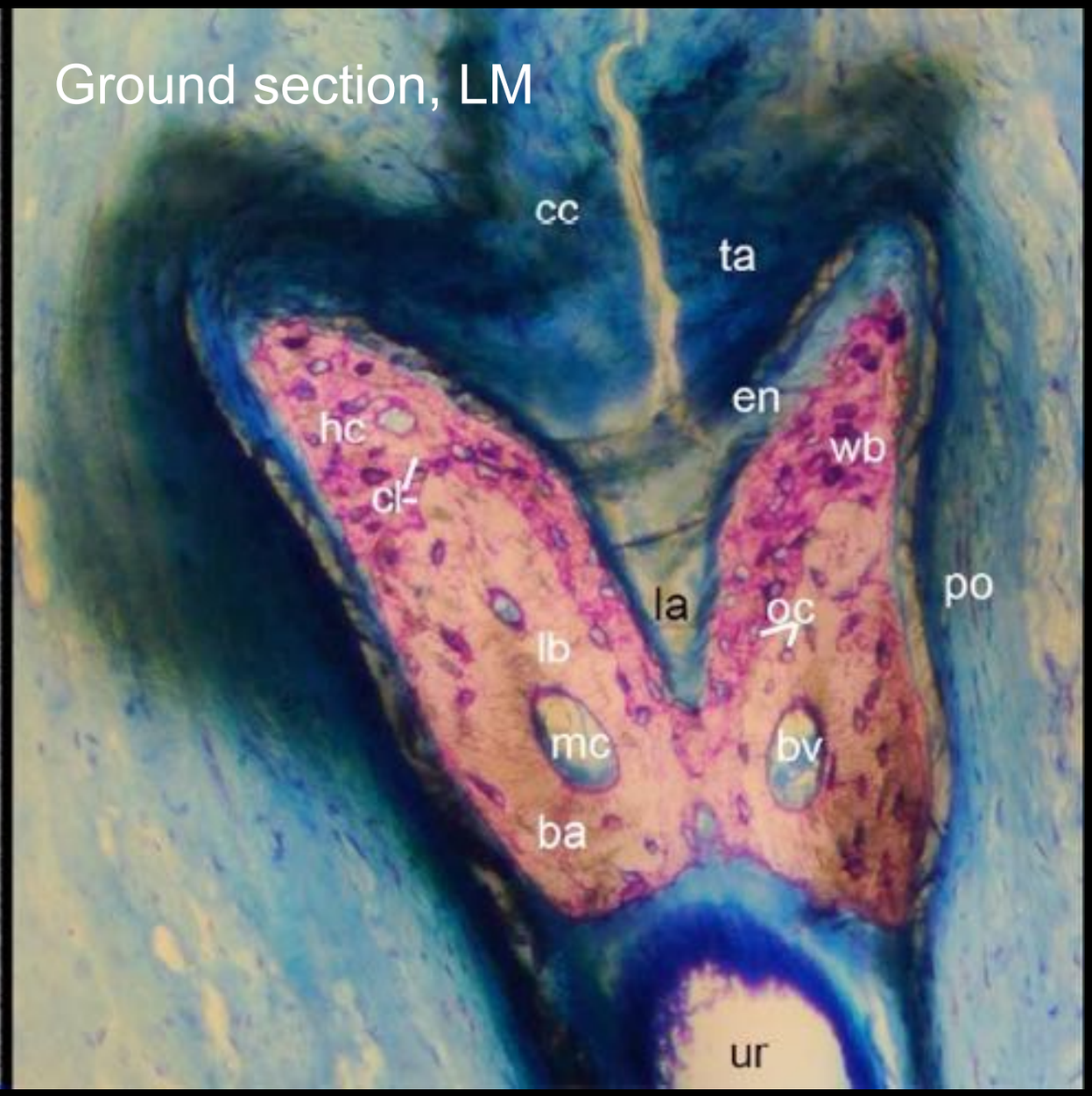
Xradia MicroXCT

Work of Anna Nele Herdina, Theoretical Biology, UniVie

Correlative imaging

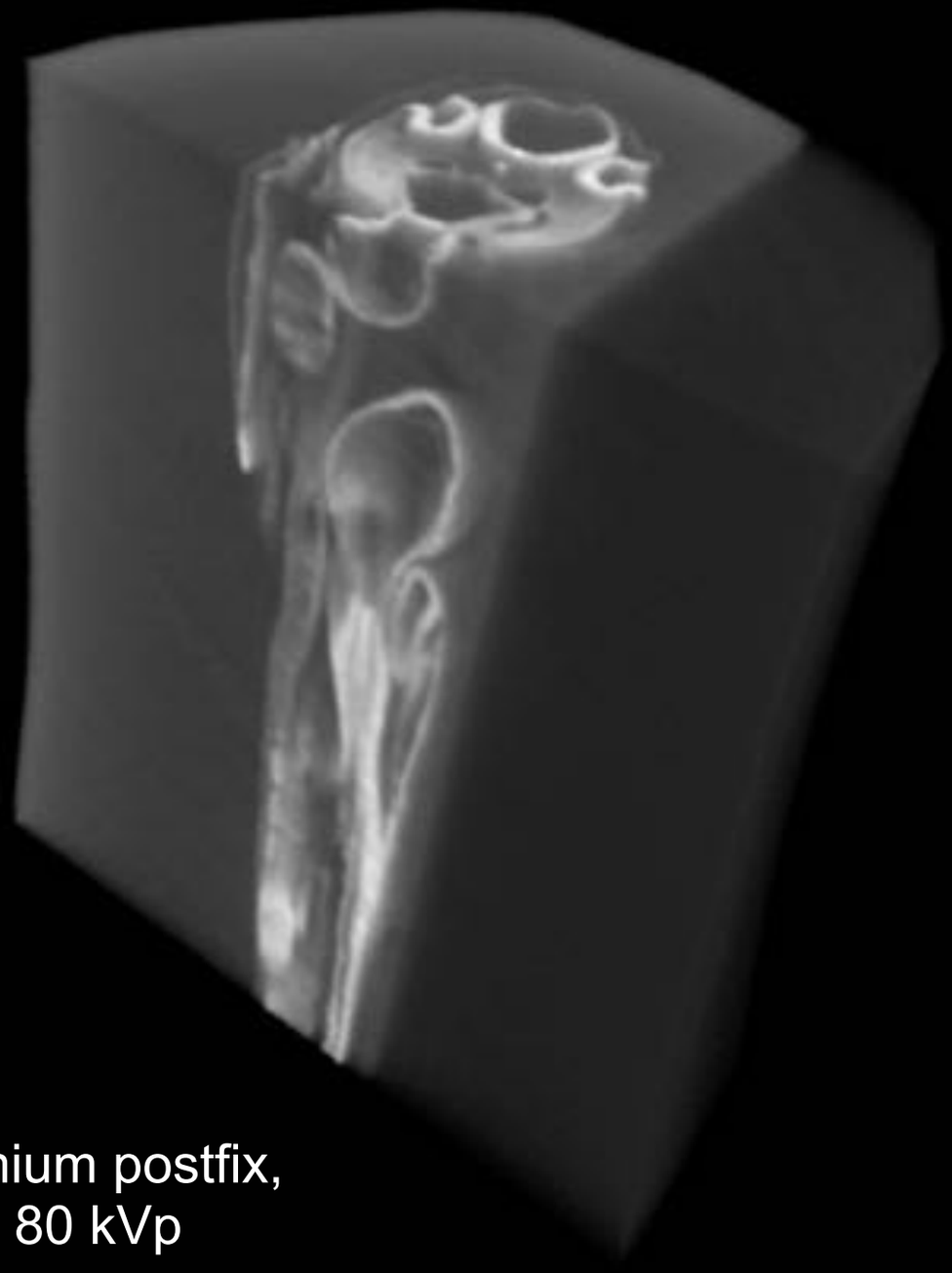
Ground sections to calibrate microCT images:
Bat baculum histomorphology





Nele Herdina et al. in press, J. Morph.

Samples prepared for TEM
can be scanned in the block



osmium postfix,
80 kVp

Cross-platform imaging

MicroCT

↓

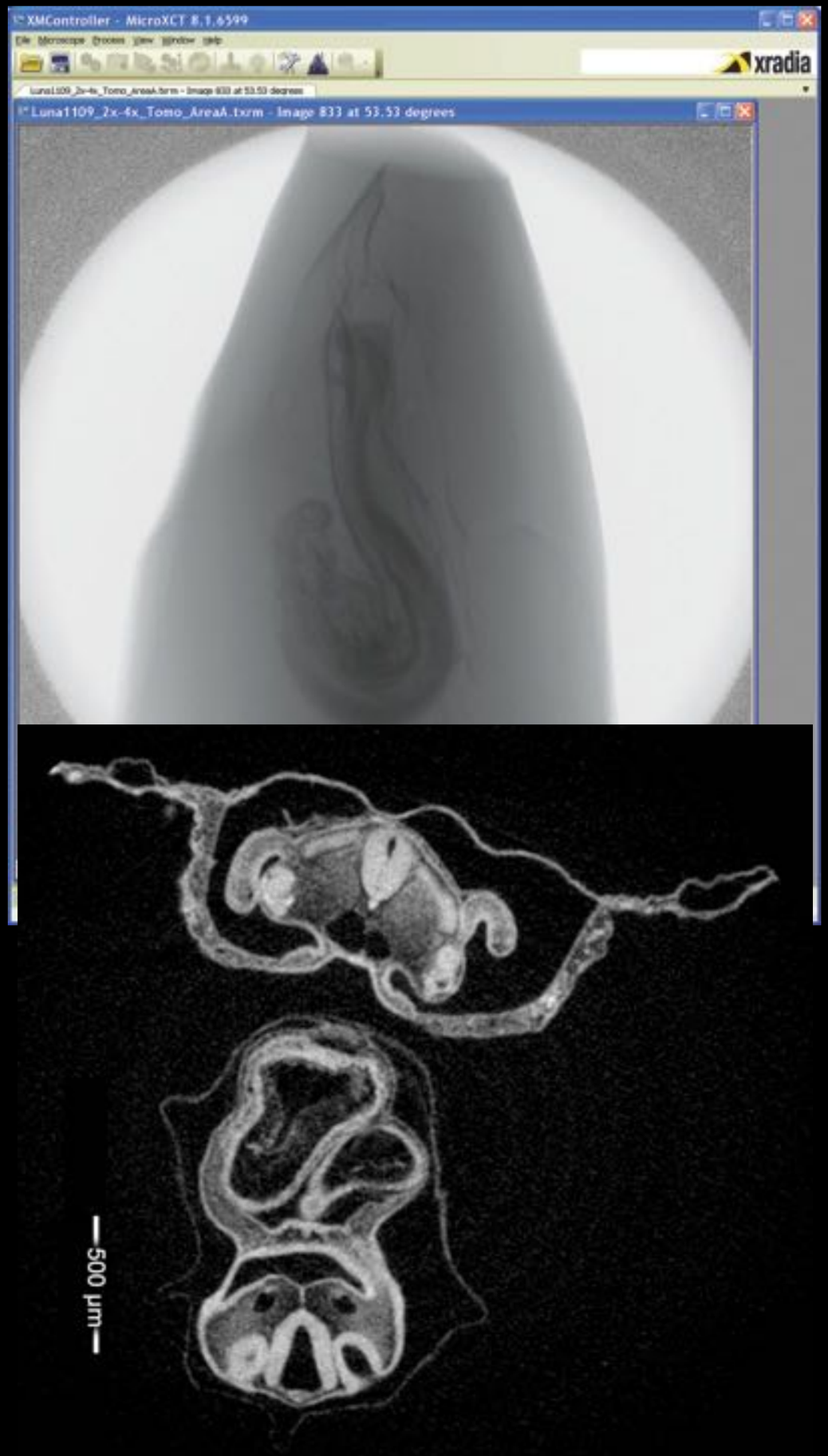
Light microscopy

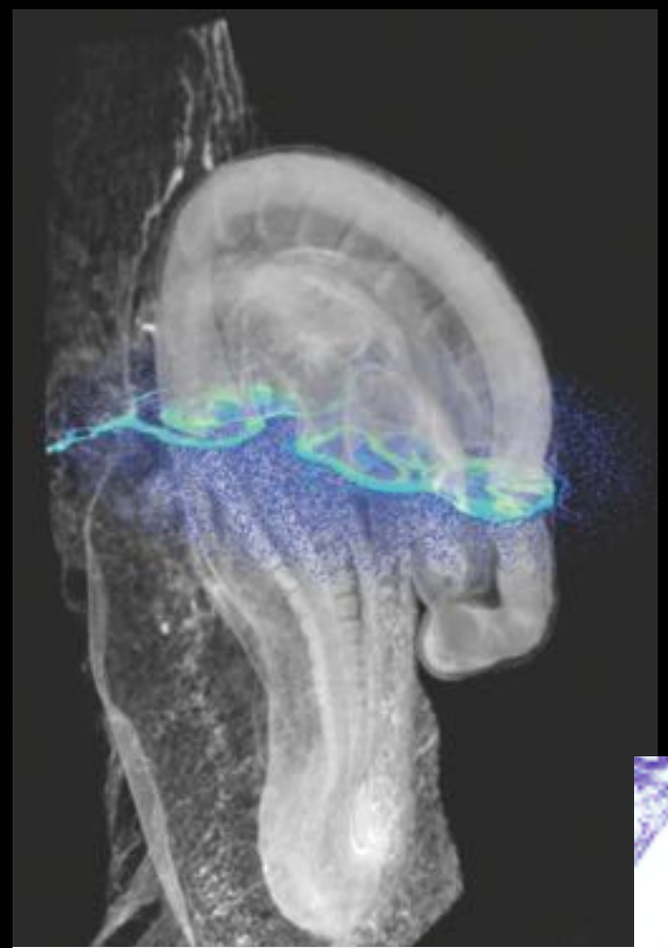
↓

TEM

Horse embryo (21 days), osmium stained and resin embedded

Collaboration with Stephan Handschuh and Ingrid Walter, Vet Med Uni Vienna.

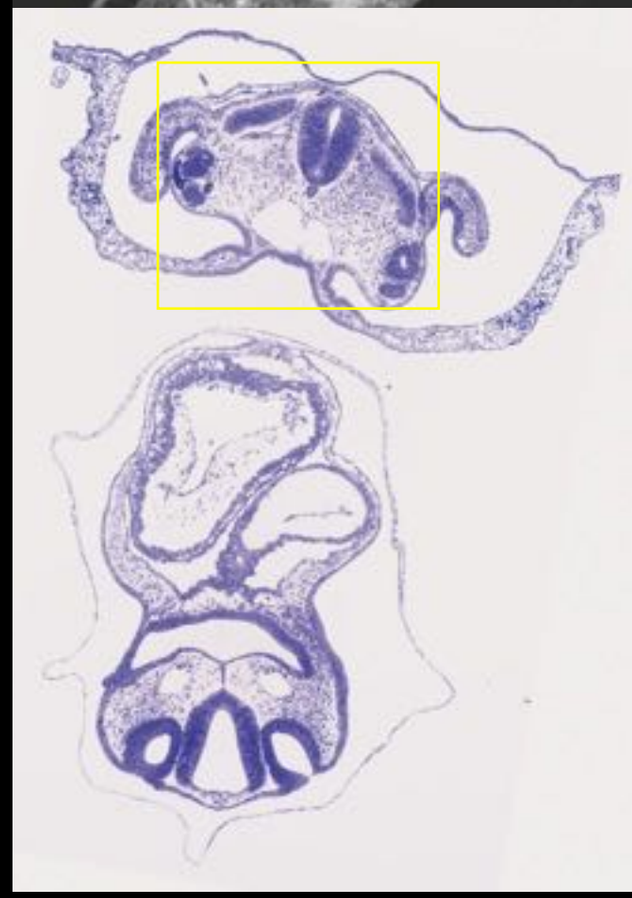




Cross-platform imaging

Horse embryo, 21 days

With Stephan Handschuh
and Ingrid Walter,
Vet Med Uni Vienna.



Sections of the same block:
semi-thin and toluidine blue
for histology

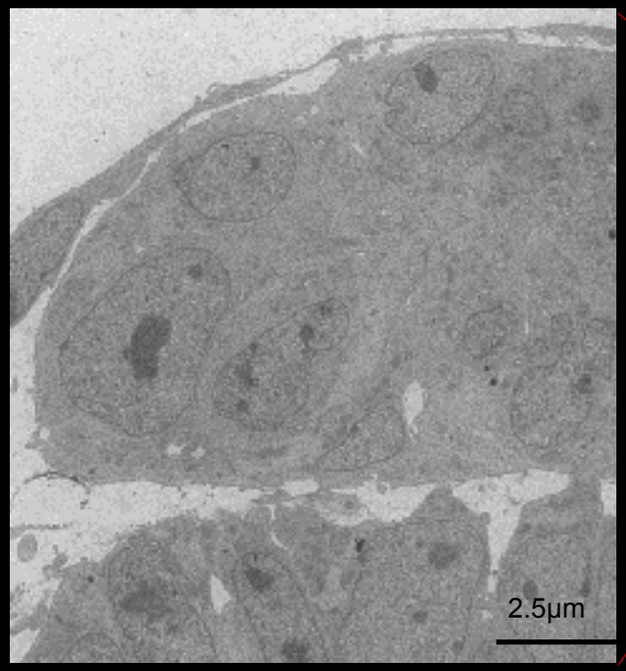
Handschuh *et al. Frontiers in Zoology* 2013, **10**:44
http://www.frontiersinzoology.com/content/10/1/44

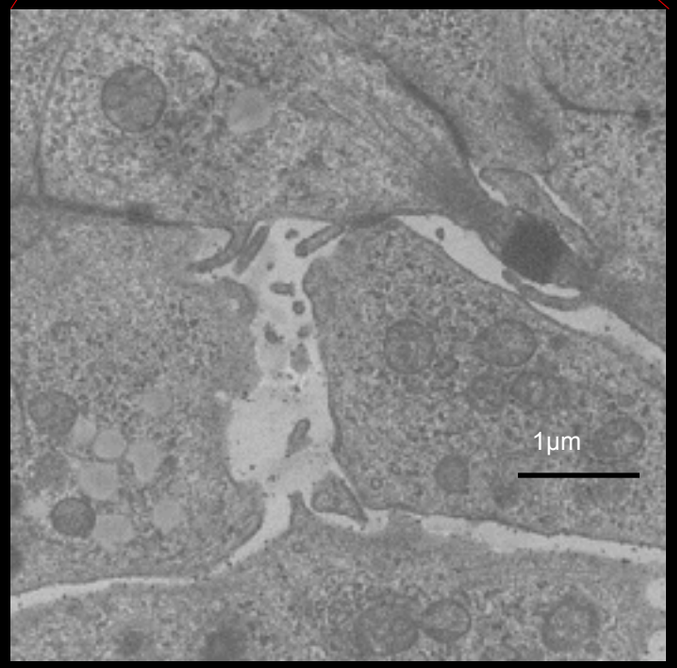
FRONTIERS IN ZOOLOGY

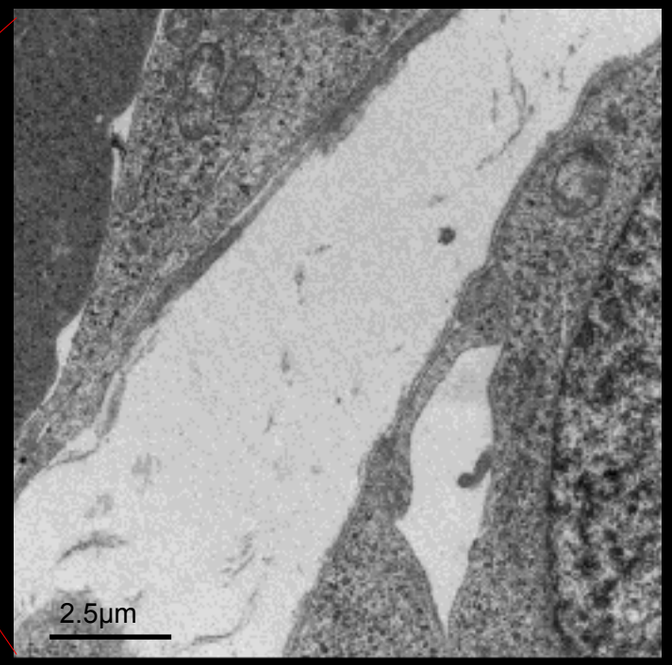
METHODOLOGY Open Access

A correlative approach for combining microCT, light and transmission electron microscopy in a single 3D scenario

Stephan Handschuh[1,2,3*], Natalie Baeumler[4], Thomas Schwaha[5] and Bernhard Ruthensteiner[4]

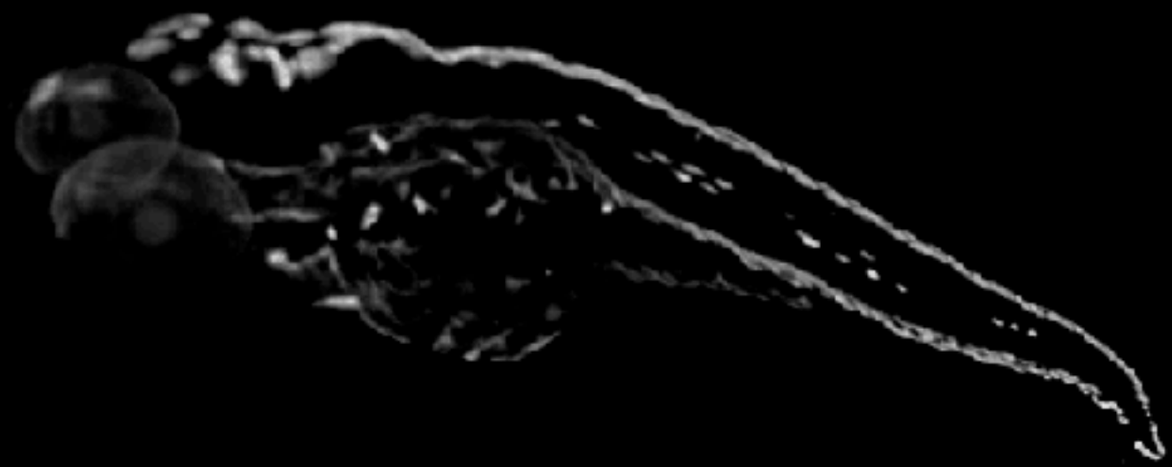






TEM of pronephros (kidney) development, with its 3D context

Other projects:
Cell-type-specific imaging



Selective contrasting of melanocytes in zebrafish
using autometallography

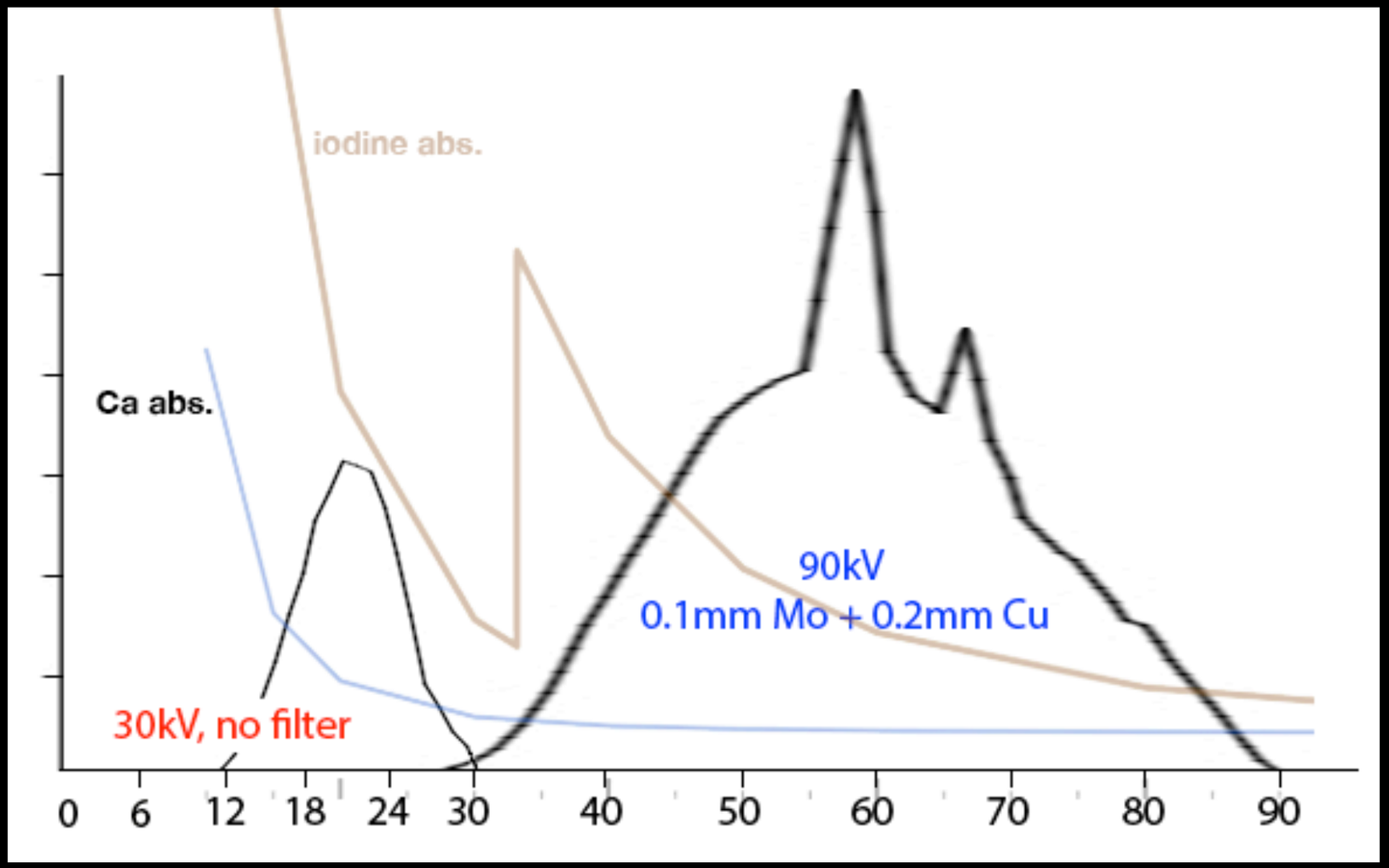
Imaging molecular probes

Acetylated alpha-tubulin, st. 23 chick

Imaging molecular probes with microCT

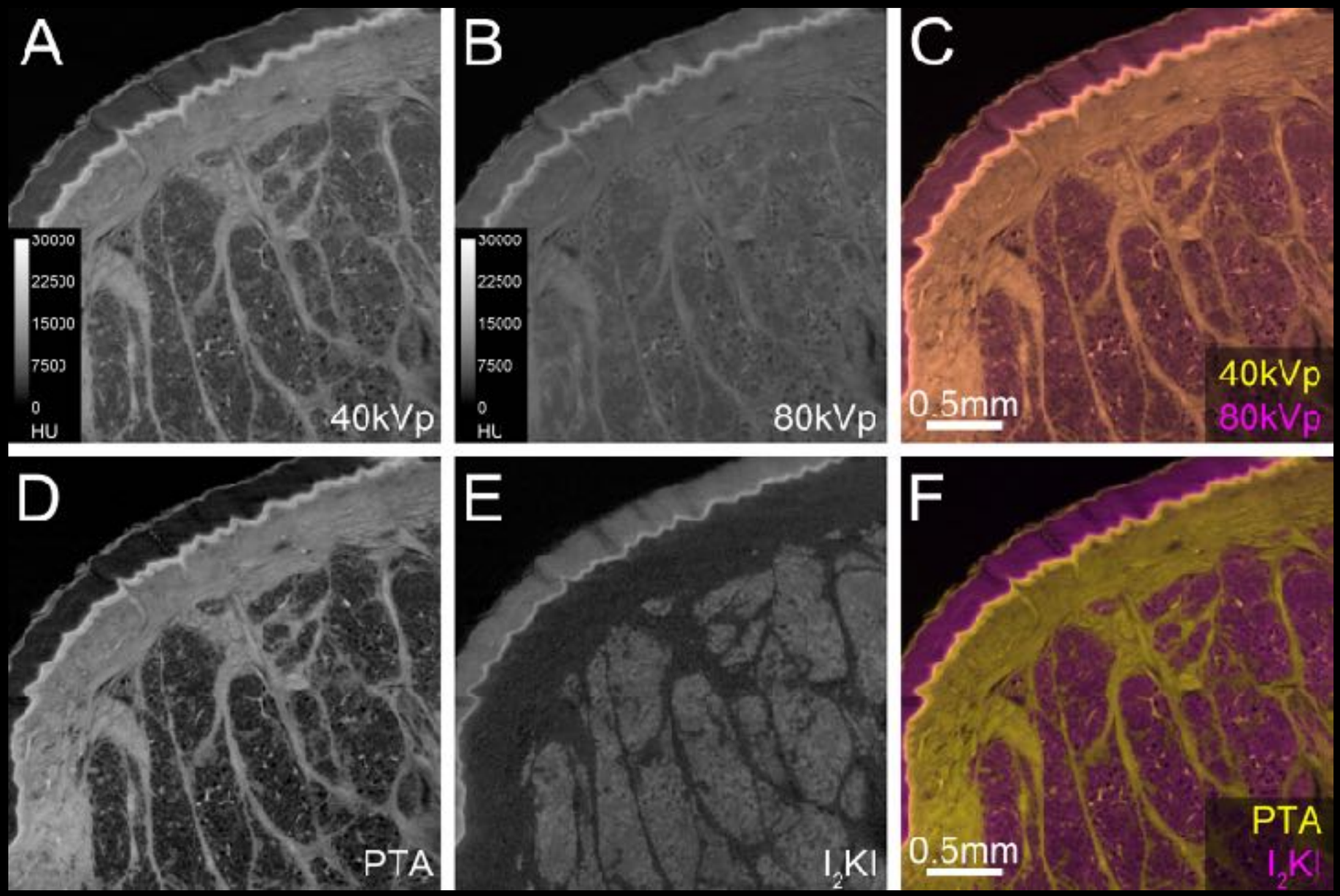
Acetylated alpha-tubulin, st. 23 chick

Dual-energy microCT can distinguish different materials in the sample



Handschuh S, Beisser CJ, Ruthensteiner B and Metscher BD. 2017. Microscopic dual energy CT (microDECT): a flexible tool for multi-channel ex vivo 3D imaging of biological specimens. Journal of Microscopy, In press.

Dual-energy microCT can distinguish different materials in the sample



Double-stained cat digit pad, collagenous and adipose tissues.

Handschuh S, Beisser CJ, Ruthensteiner B and Metscher BD. 2017. Microscopic dual energy CT (microDECT): a flexible tool for multi-channel ex vivo 3D imaging of biological specimens. Journal of Microscopy, In press.

Meshes and models from 3D images

Snapshots, scale bars in Fiji & Amira

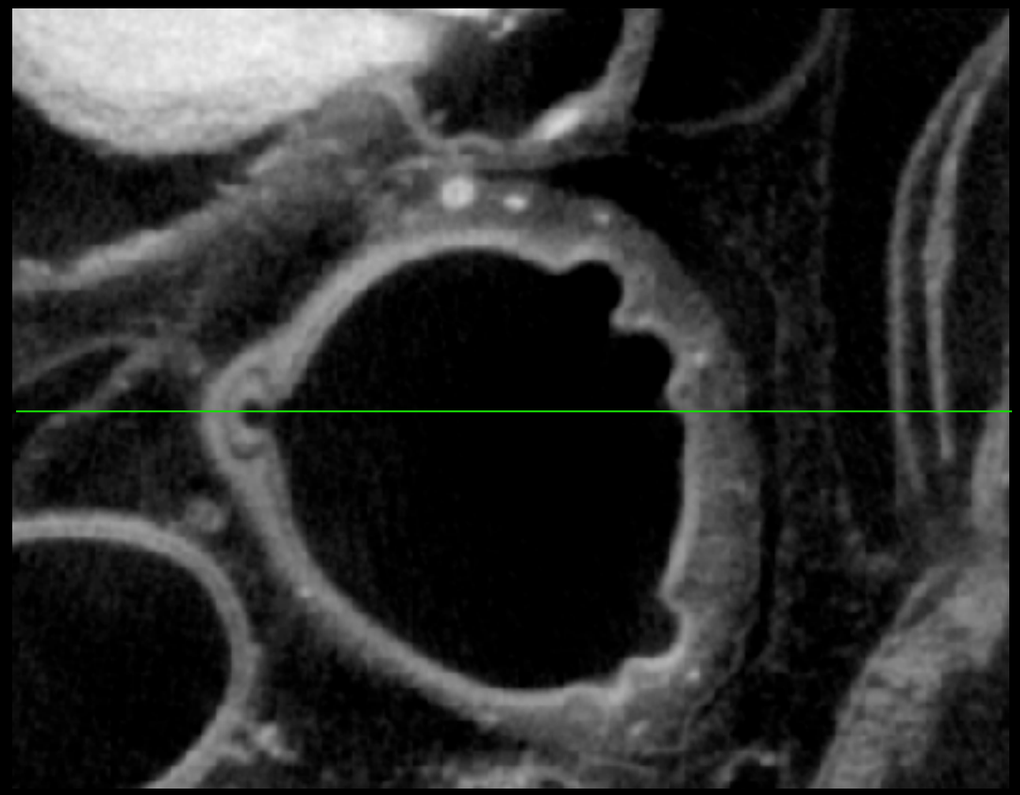
and filters

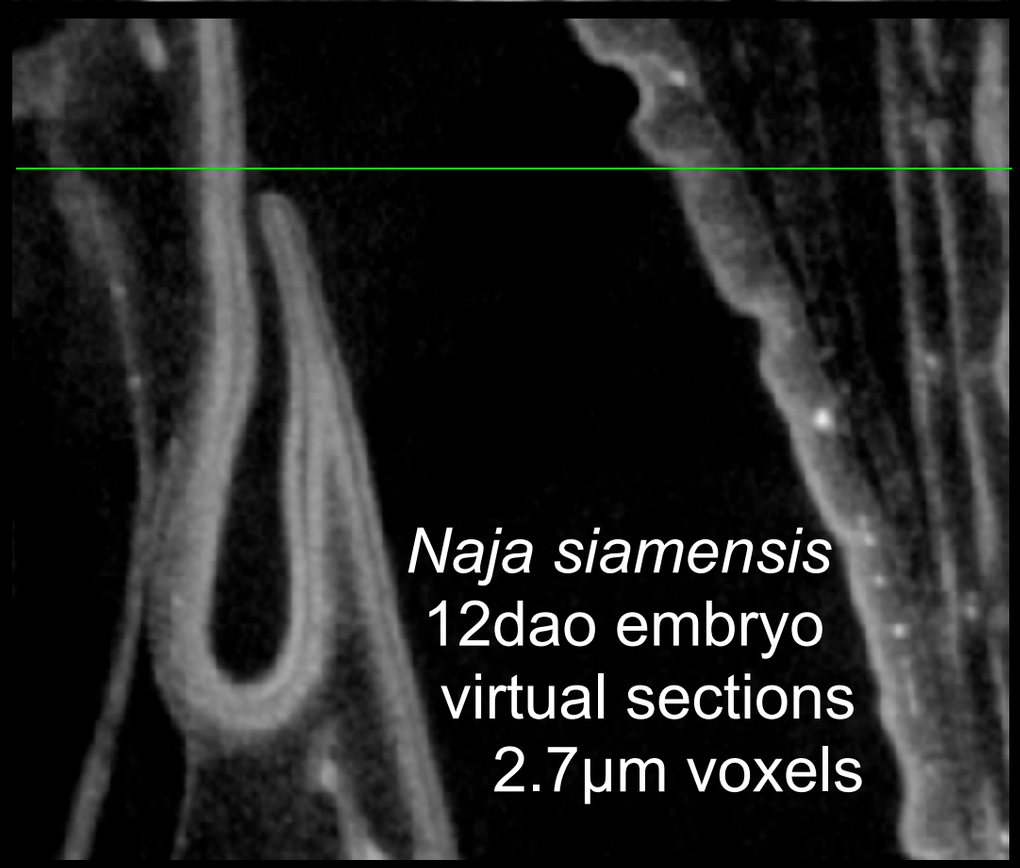
Other free 3D image software

check out idoimaging.com

Images communicate: what does your picture say?

Naja siamensis
(cobra) 1dao
embryo

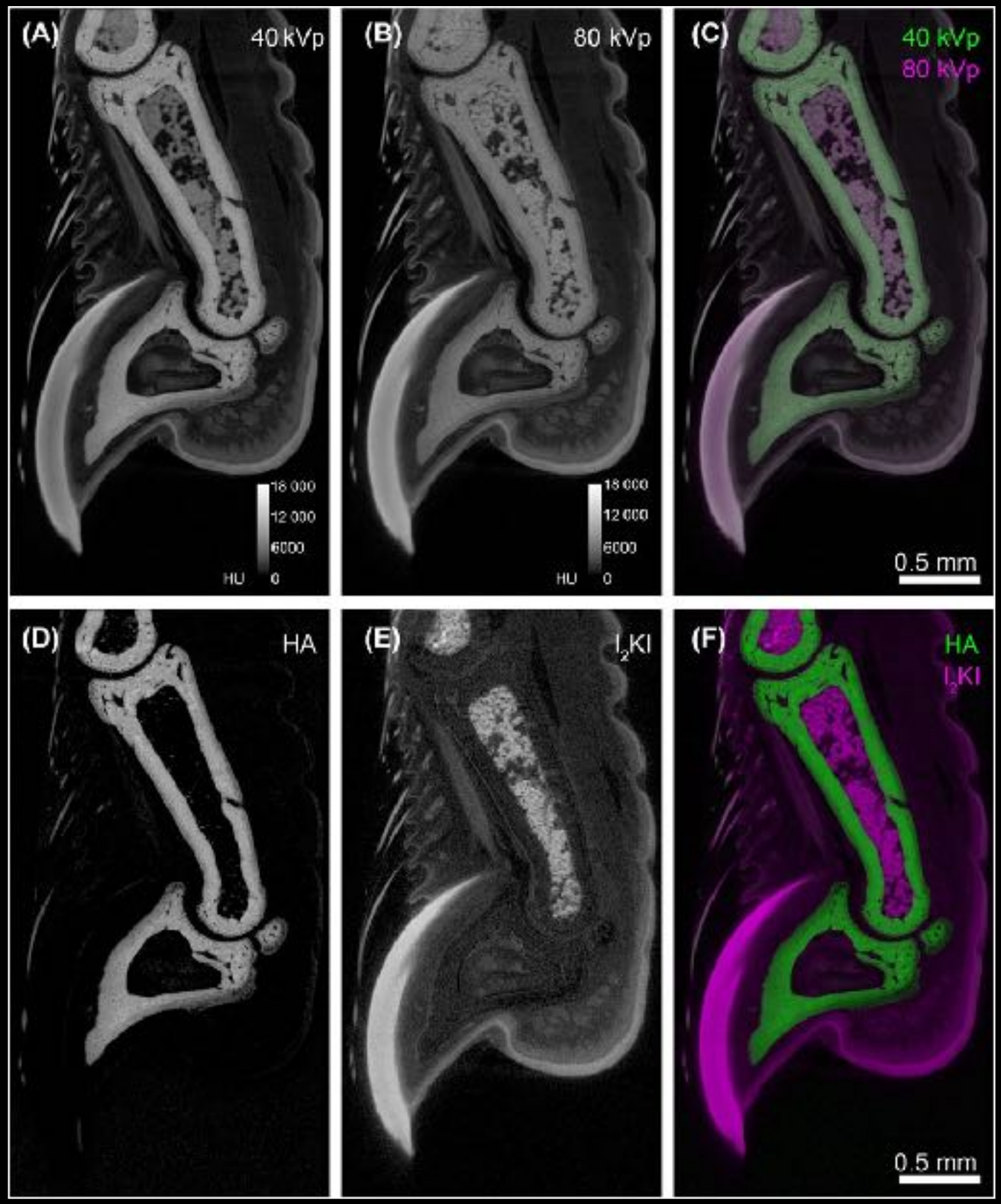




Naja siamensis
12dao embryo
virtual sections
2.7µm voxels

van Soldt et al., 2015, PLoS ONE 10

Images communicate: what does your picture say?



Handschuh et al 2017. J Microsc, In press.

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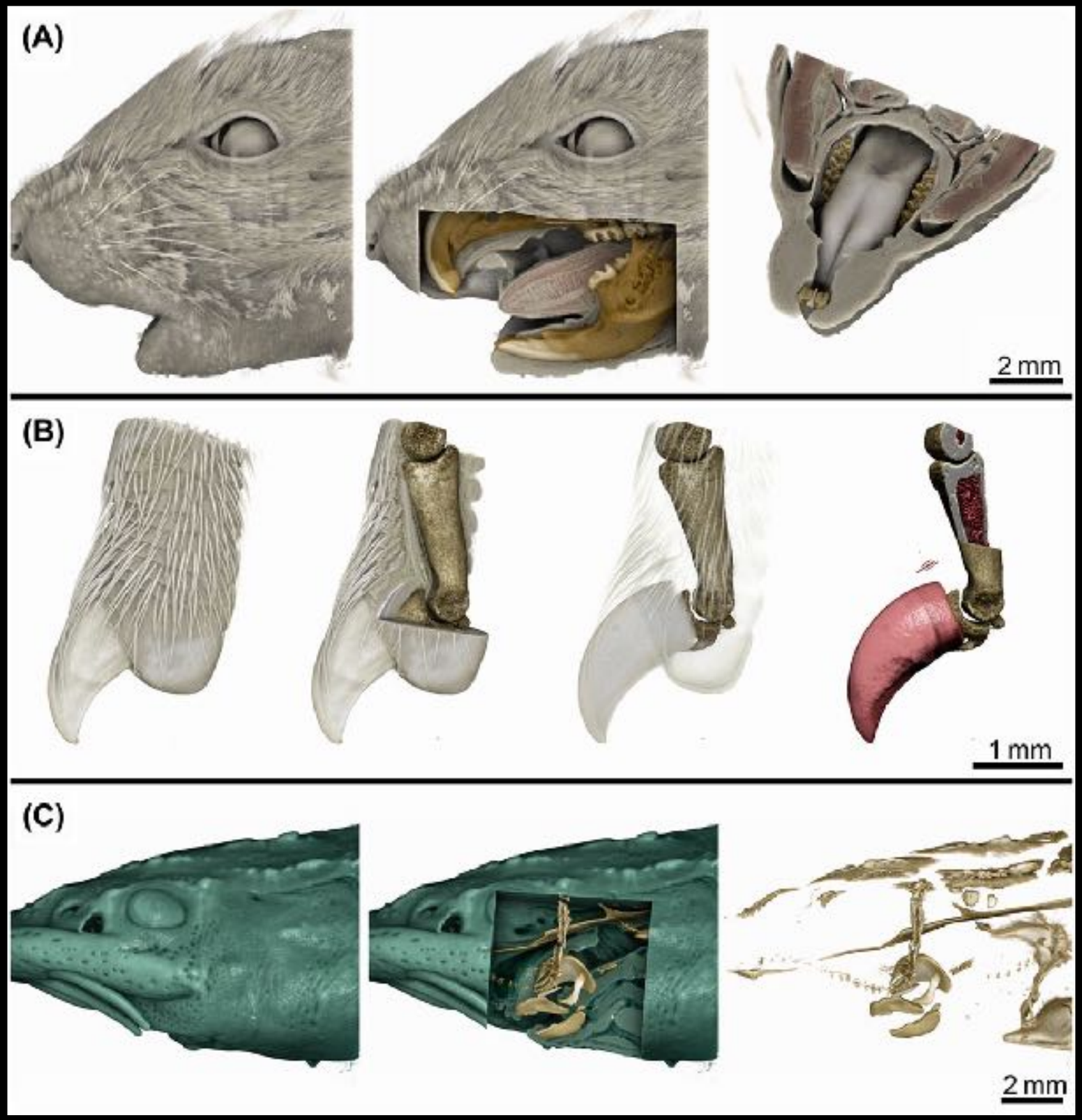
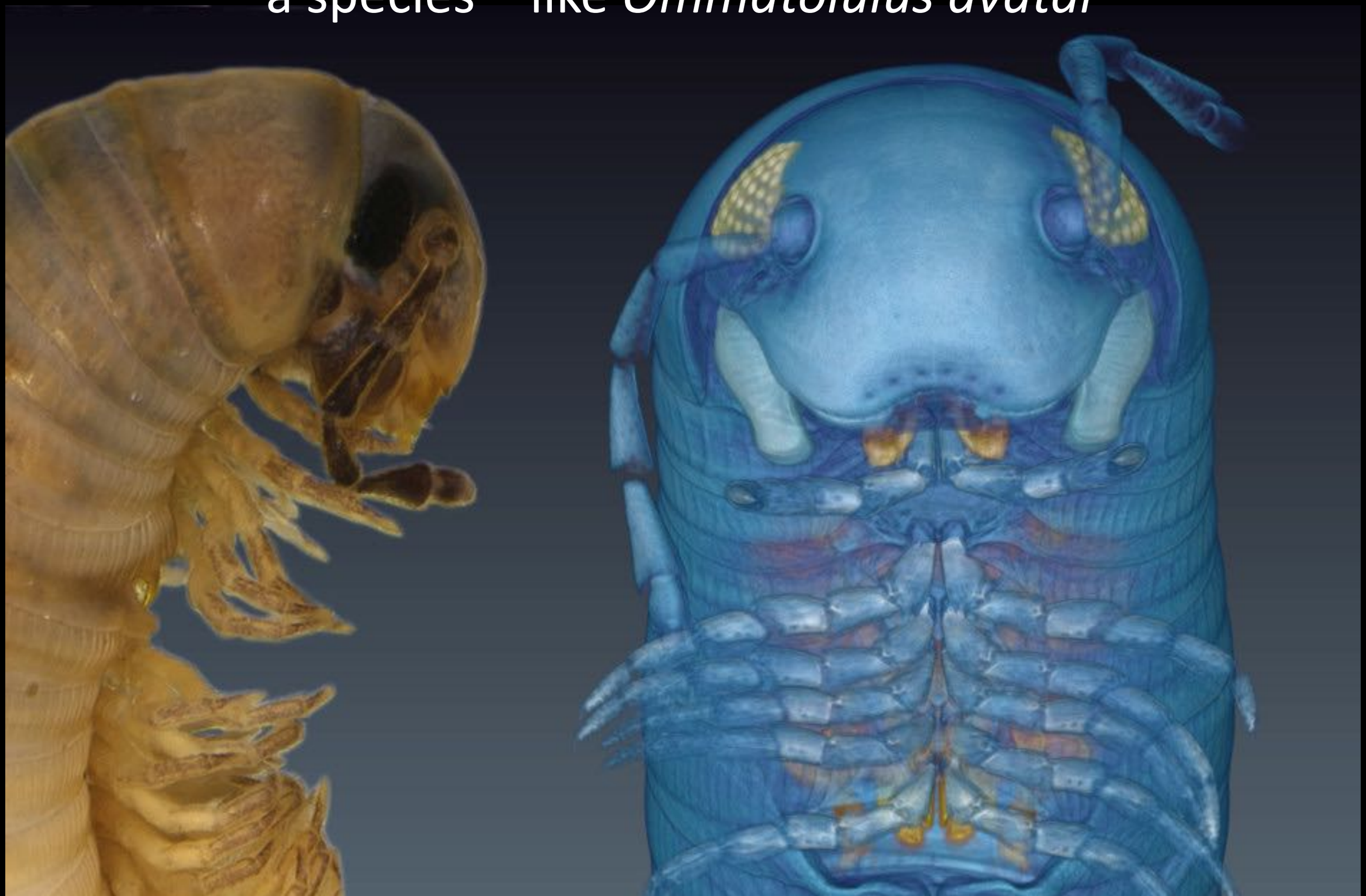


Handschuh et al 2017. J Microsc, In press.

Cybertype: a virtual specimen that helps define a species – like *Ommatoiulus avatar*



Cybertypes provide online access to 3D micromorphology

http://www.datadryad.org/resource/doi:10.5061/dryad.2pf38

Data from: A new dimension in documenting new species: high-detail imaging for myriapod taxonomy and first 3D cybertype of a new millipede species (Diplopoda, Julida, Julidae)

PLOS | ONE

Files in this package

Title	O-avatar_holotype_I2E_3-0um_PNG
Downloaded	76 times
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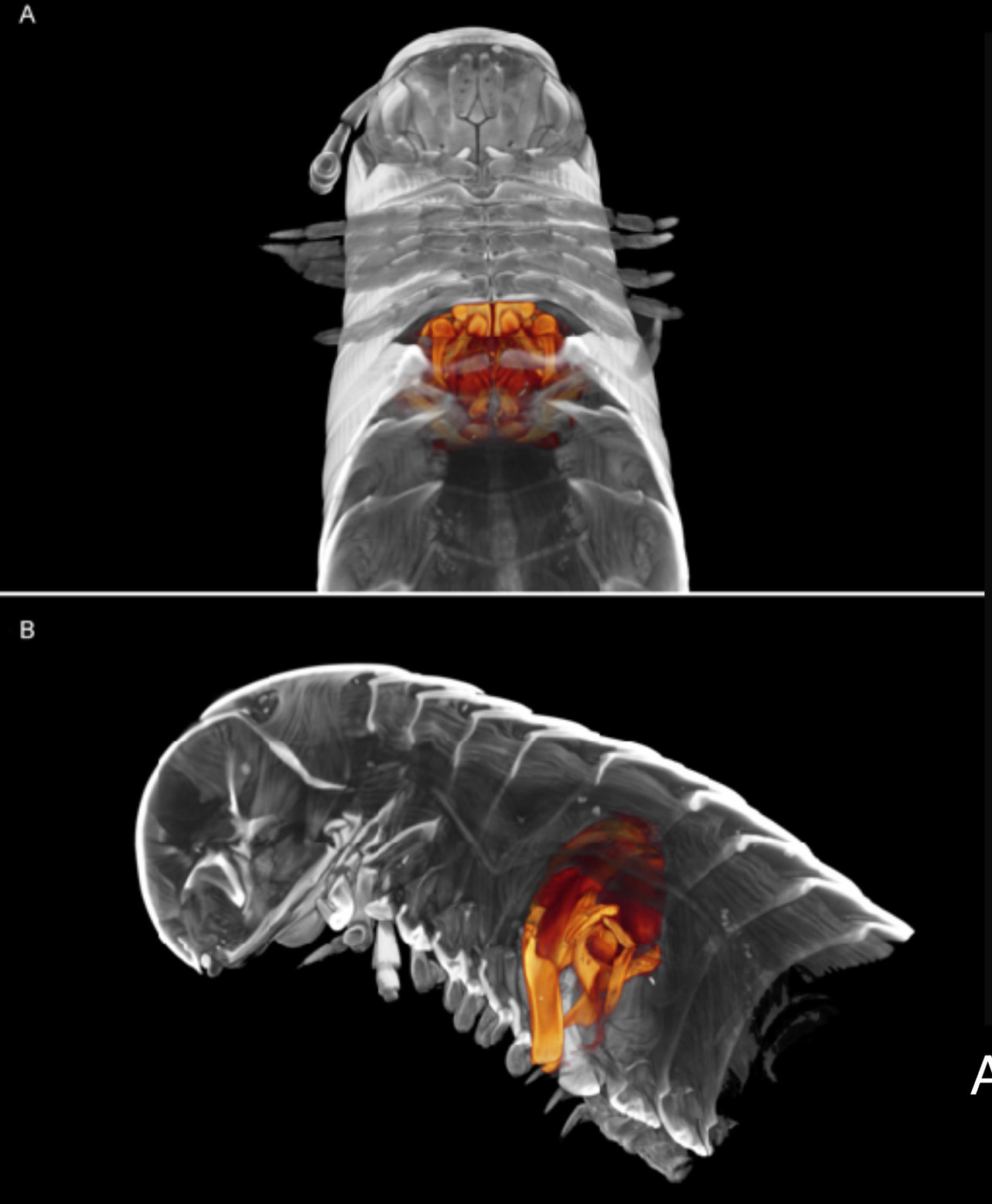
Details	View File Details

Cybertype: a virtual specimen that helps define a species – like *Ommatoiulus avatar*



Akkari, N., H. Enghoff and B. Metscher (2015). *PLoS ONE* **10**(8): e0135243.

Image ethics: publish responsibly

D. W. Cromey: Ethical guidelines for the appropriate use and manipulation of scientific digital images

1. Scientific digital images are data that can be compromised by inappropriate manipulations.
2. Manipulation of digital images should only be performed on a copy of the unprocessed image data file (Always keep the original data file safe and unchanged!).
3. Simple adjustments to the entire image are usually acceptable.
4. Cropping an image is usually acceptable.
5. Digital images that will be compared to one another should be acquired under identical conditions, and any post-acquisition image processing should also be identical.
6. Manipulations that are specific to one area of an image and are not performed on other areas are questionable.
7. Use of software filters to improve image quality is usually not recommended for biological images.
8. Cloning or copying objects into a digital image, from other parts of the same image or from a different image, is very questionable.
9. Intensity measurements should be performed on uniformly processed image data, and the data should be calibrated to a known standard.
10. Avoid the use of lossy compression.
11. Magnification and resolution are important.
12. Be careful when changing the size (in pixels) of a digital image.

These guidelines can also be found as part of the "Online Learning Tool for Research Integrity and Image Processing" http://www.uab.edu/researchintegrityandimages/ or: http://ori.dhhs.gov/education/products/RIandImages/

Where to publish?

- Dryad
- Figshare
- GigaDB
- Github
- Zenodo
- MorphoBank
- MorphoDBase
- MorphoMuseuM
- MorphoSource

Type of data (volume, surface, analyses...) ?
Size restriction?
Costs?
Type of license for re-use?
Globally unique identifier (DOI) offered?

What metadata should you publish?

S. Faulwetter, N. Minadakis, K. Keklikoglou, M. Doerr, C. Arvanitidis
First steps towards the development of an integrated metadata management system for biodiversity-related micro-CT datasets.
https://www.bruker.com/fileadmin/user_upload/8-PDF-Docs/PreclinicalImaging/microCT/2015/uCT2015-27.pdf

Davies TG et al., Donoghue PCJ. (2017).
Open data and digital morphology.
Proceedings of the Royal Society B: Biological Sciences 284(1852).
http://rspb.royalsocietypublishing.org/content/royprsb/284/1852/20170194.full.pdf

Science begins here:

and WONDER!