Integration of MRI into the NSF's oVert Program.

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Introduction.

"The oVert (openVertebrate) Thematic Collection Network (TCN) is generating high-resolution digital three-dimensional data for internal anatomy across vertebrate diversity. At a network of digitization centers across the US, the team is CT-scanning >20,000 fluid-preserved specimens representing >80% of the living genera of vertebrates to generate high-resolution digital anatomical data, represented as both 2D image stacks and 3D volumes and surfaces, which can be distributed globally through the on-line data portal MorphoSource. With these 3D digital specimens, US and international research communities will be able to (1) diagnose, describe, and infer patterns of relationships among both living and extinct vertebrates, (2) test hypotheses of morphological evolution such as patterns of disparity, modularity, and phenotype-environment correlations, (3) develop structure-function models for testing hypotheses about morphological adaptations related to, e.g., feeding and locomotion, and (4) explore relationships between brain and nervous system anatomy and both sensory and musculoskeletal function. oVert is a collaboration between 18 institutions across the US, including 16 major US museums, with the Florida Museum of Natural History at UF being the lead institution and coordinating center. In addition, there are 41 other investigators from 17 institutions that form the complete team" (1).

The goal of this NHMFL pilot project is to determine what role MRI can play for oVert. Challenges include a large range of sample sizes requiring the full range of MR systems available at UF and the NHMFL, the relative cost of MRI, and also that the samples are fixed in 70% ethanol posing challenges with chemical shift artefacts from at least 5 distinct resonances, since on the larger samples at least it will not be feasible to exchange the ethanol for water

Experimental.

For a first experiment a platypus was obtained for study. Since full 3D whole body imaging is required for this cat size animal the most suitable scanner was a human 3T system using the pelvic array coil. Fat suppression was employed.

Results and Discussion

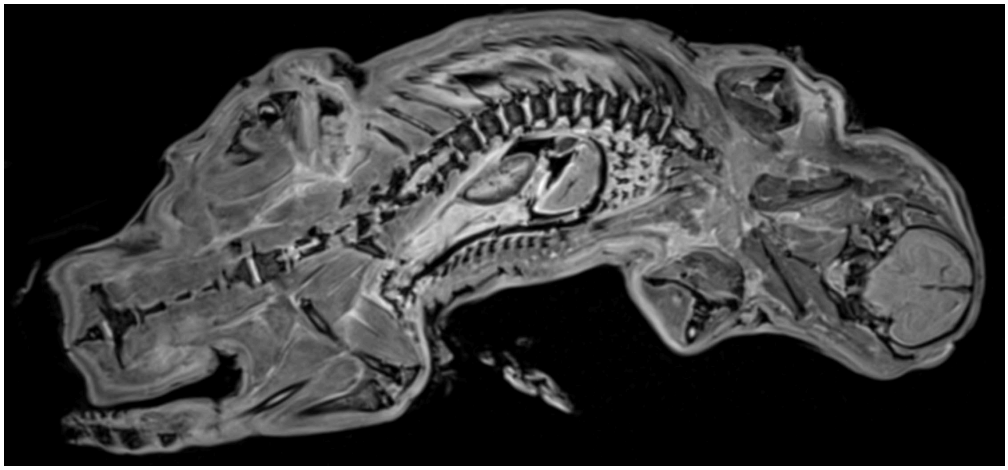

Figure 1. Example image from a 3D isotropic MRI data set of a platypus collected ~100 years ago.

Conclusions

This demonstrates the feasibility of obtaining artefact free images at 3T due to peak overlap and the use of fat suppression. Higher field studies are yet to be performed and may cause problems. Still, we are encouraged by the excellent soft tissue contrast offered by MRI as a complement to the CT studies. The coming months will see examination of a wide range of samples, evaluating different MRI contrasts and techniques such as nerve fiber tracking, determining the need for custom rf coils, and the establishment of a suitable multi-center approach to this very large collection.

Acknowledgements

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References

(1) A full description of the oVert program can be found here:

https://www.idigbio.org/wiki/index.php/OVert:_Open_Exploration_of_Vertebrate_Diversity_in_3D