Using machine learning to quantify the cellular and vascular subcomponents of the neuropil space in five regions of the crocodilian brain.

Susan Xia DO '26[1], Chet C. Sherwood PhD[2] Brendon K. Billings PhD[3], Paul R. Manger PhD[3] and Muhammad A. Spocter, PhD[1,2,4]

[1]*Department of Anatomy, Des Moines University, Des Moines*
[2]*Department of Anthropology and Center for the Advanced Study of Human Paleobiology, The George Washington University, Washington, DC*
[3]*School of Anatomical Sciences, Faculty of Health Sciences, University of the Witwatersrand, Republic of South Africa*
[4]*Department of Biomedical Sciences, Iowa State University Vet Med.*

Historically, the study of the reptilian nervous system has received very little attention. Central to this issue, has been ongoing public and scientific misconceptions that reptiles are emotionless and unintelligent. In the following study we provide much needed empirical data on regional and individual variation in the morphology of the neuropil space in the Nile crocodile (*Crocodylus niloticus*). The neuropil space is an important intercellular component supporting the complexity of the cortical column and has been used as a robust proxy for connectional and functional differences. Using a combination of design based stereological sampling and machine learning, we sampled the neuropil space in the stained histological sections of the dorsal thalamus (DT), dorsal ventricular ridge (DVR), optic tectum (OT), torus semi-circularis (TS) and cerebrum (C) of 5 crocodiles ranging in size from 1.2Kg to 10.06 Kg. Mean neuropil space was greatest in DT> C>OT>DVR>TS. Neuropil, cellular and vascular fractions ranged from a high of 73%; 29%; 7% respectively to a low of 60%; 23%; 3%. Aside for the DVR, all other areas seemed to undergo a modest increase in neuropil space with increasing body mass, while the DVR remained constant in terms of its neuropil complement. These preliminary results provide an important step towards validating our approach for automating the extraction of neuropil data from large histological datasets and comparing these within and between species.