

Quantitative ultrastructural analysis of mitochondria in the neuropil of medial prefrontal cortex of rats exposed to chronic stress.

Dávid Csabai¹, Ove Wiborg² and Boldizsár Czéh^{1,3}

¹ Neurobiology of Stress Research Group, Szentágotthai János Research Centre, University of Pécs, Pécs, Hungary

² Department of Health Science and Technology, Aalborg University, Aalborg, Denmark

³ Institute of Laboratory Medicine, Medical School, University of Pécs, Pécs, Hungary



Aims: Chronic mild stress (CMS) protocol is a behavioral model to mimic a core depression symptom -anhedonia- in experimental rats, and also a great tool for examining neurobiological alterations contributing to the disease. Our previous study has shown cellular changes in the medial prefrontal cortex (mPFC) of chronically stressed rats. Redox imbalance hypothesis is a theory explaining the probable mechanism of subcellular biochemical changes in response to stress. Since mitochondria (MIT) are major producers of numerous reactive oxygen species (ROS), it is feasible that behavioral, stress-induced oxidative stress can lead to morphological and numeral alterations of MIT. Our aim was to identify these possible changes in chronically stressed rats.

Methods: We applied quantitative electron microscopic analysis to determine density and morphology of mitochondria in the mPFC of control (n=4) and CMS exposed (n=4) rats. We focused on the infralimbic region of mPFC and we did a random systematic sampling procedure to take ultrastructural images with a transmission electron microscope (TEM) at 40000x magnification. Images were analyzed with unbiased stereology protocol.

Results: Circa 3500 EM images were examined, and we counted 55000 mitochondria. Morphological parameters were evaluated on 10000 structures. MIT density and morphology were similar in both groups, yet total MIT numbers were reduced in anhedonic animals.

Conclusions: Except total MIT numbers, we found no significant difference between the two groups. Our present data could not reveal any stress-induced morphological changes affecting neuronal mitochondria.

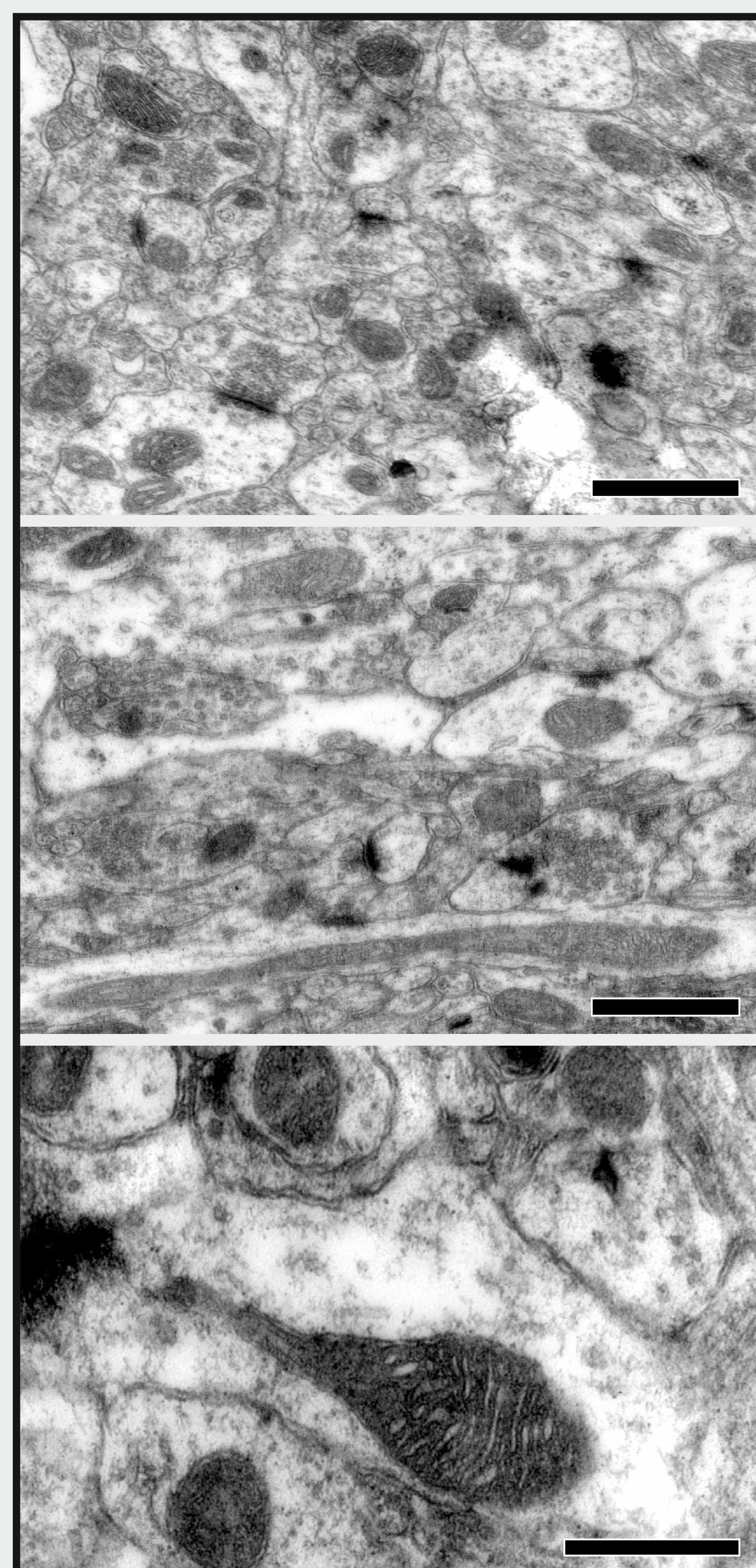
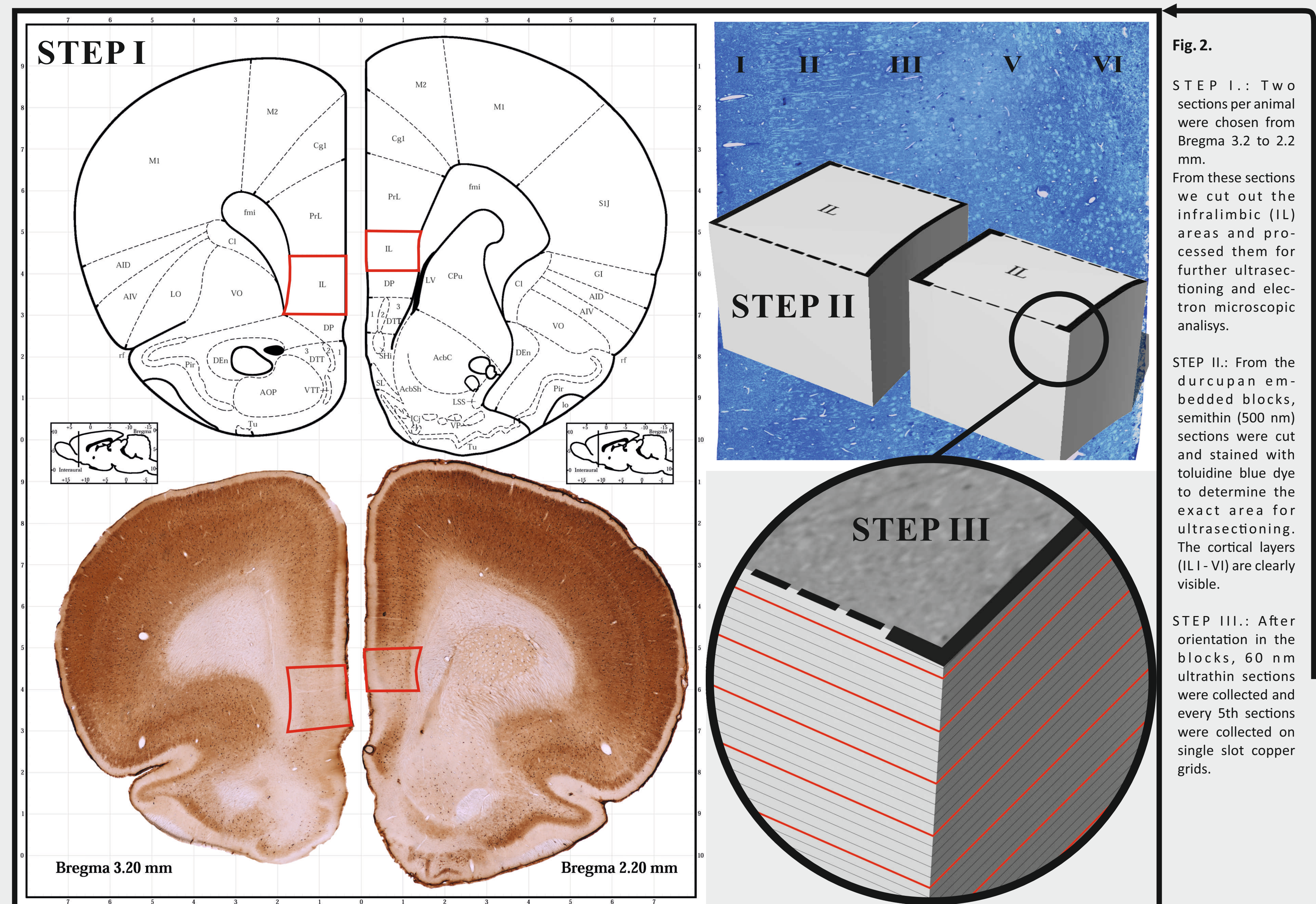
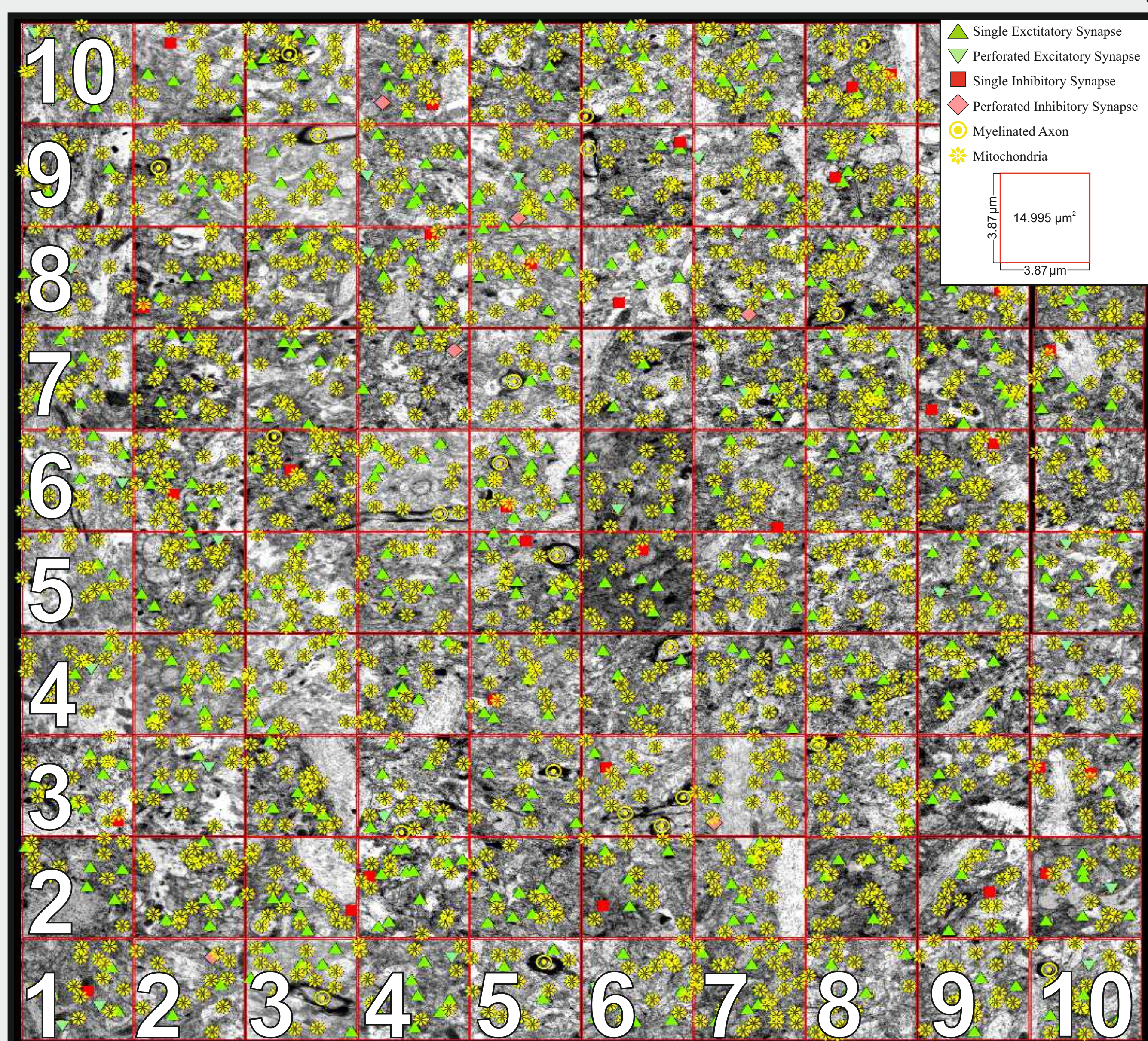
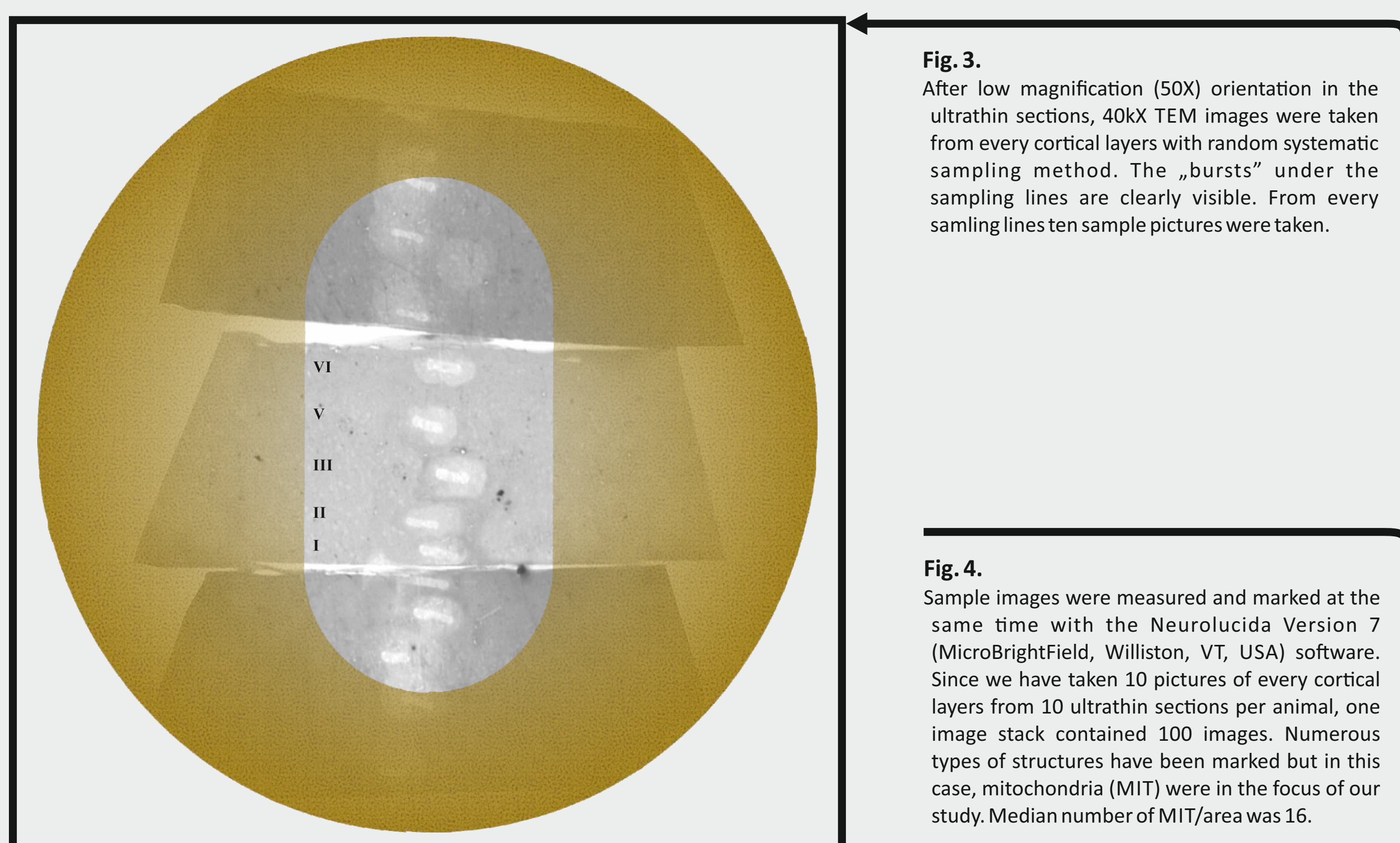
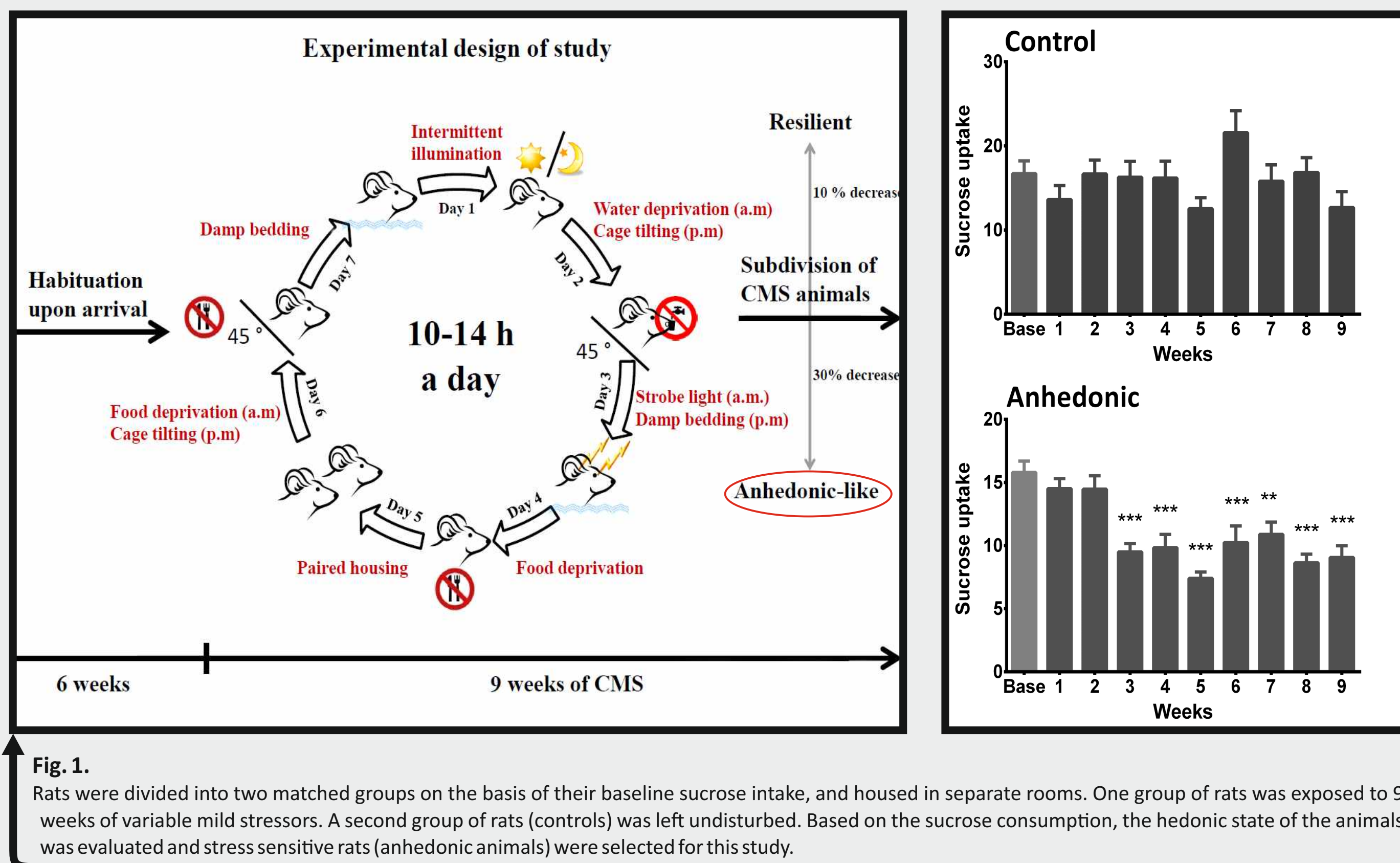


Table 1. Results of quantitative EM analysis: Group values

	Control	Stress
Density of MIT in the IL cortex (n/μm ³)	16.91 ± 1.02	16.17 ± 1.30
Area of measured MIT structures (μm ²)	0.06 ± 0.05	0.07 ± 0.01
Total number of MIT in the IL cortex (n)	3.59 × 10 ⁹	2.93 × 10 ⁹

Data are expressed as mean ± S.E.M.

