

Molecular characterization of cholinergic vestibular and olivocochlear efferents in the rodent brainstem



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Introduction

The neural code from the inner ear to the brain is controlled by a cholinergic central nervous efferent feedback to the hearing and balance organs, the function of which is unknown. This project investigates the applicability of a transgenic mouse model, expressing GFP in cholinergic cells, for targeting the vestibular and olivocochlear efferent neurons. Further, the presence of the Kv4 family of potassium channel subunits were investigated in these neurons.

Results II

Kv4.3 is expressed in vestibular and olivocochlear efferents and also in LSO principal cells.

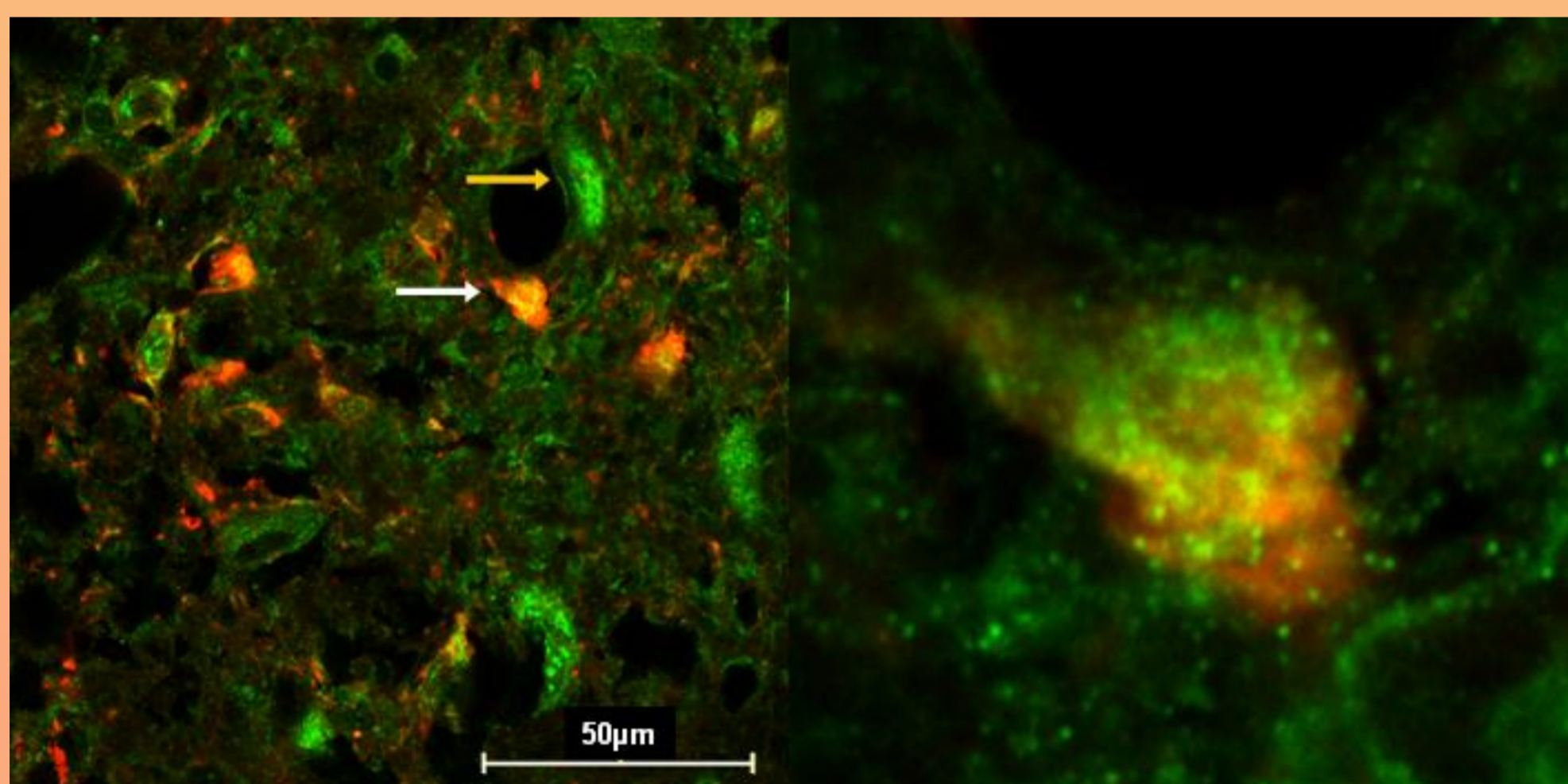


Figure 2. Confocal images of adult rat LSO. Olivocochlear efferents (white arrow and enlargement) are immunopositive for both Kv4.3 (green) and the cholinergic marker ChAT (red), while LSO principal cells (yellow arrow) only express Kv4.3.

Conclusion

This transgenic mouse model lends itself for targeting the vestibular efferents, which can be identified with fluorescence and subsequently recorded from with electrophysiological techniques. Further, we found robust expression of the Kv4.3 potassium channels in identified olivocochlear and vestibular efferents, probably causing a transient low threshold potassium current in these neurons. This ion channel subunit was also found in other parts of the superior olivary complex, usually associated with sound localization.

Methods

Transgenic mice positive for eGFP were identified using PCR. Double immunolabelling was performed on brain tissue that had been fixed with PFA either 1) via transcardial perfusion, or 2) via immersion fixation after shock-freezing and sectioning.

Results I

The transgenic mice express eGFP in vestibular efferents and motor neurons, but not in olivocochlear efferents.

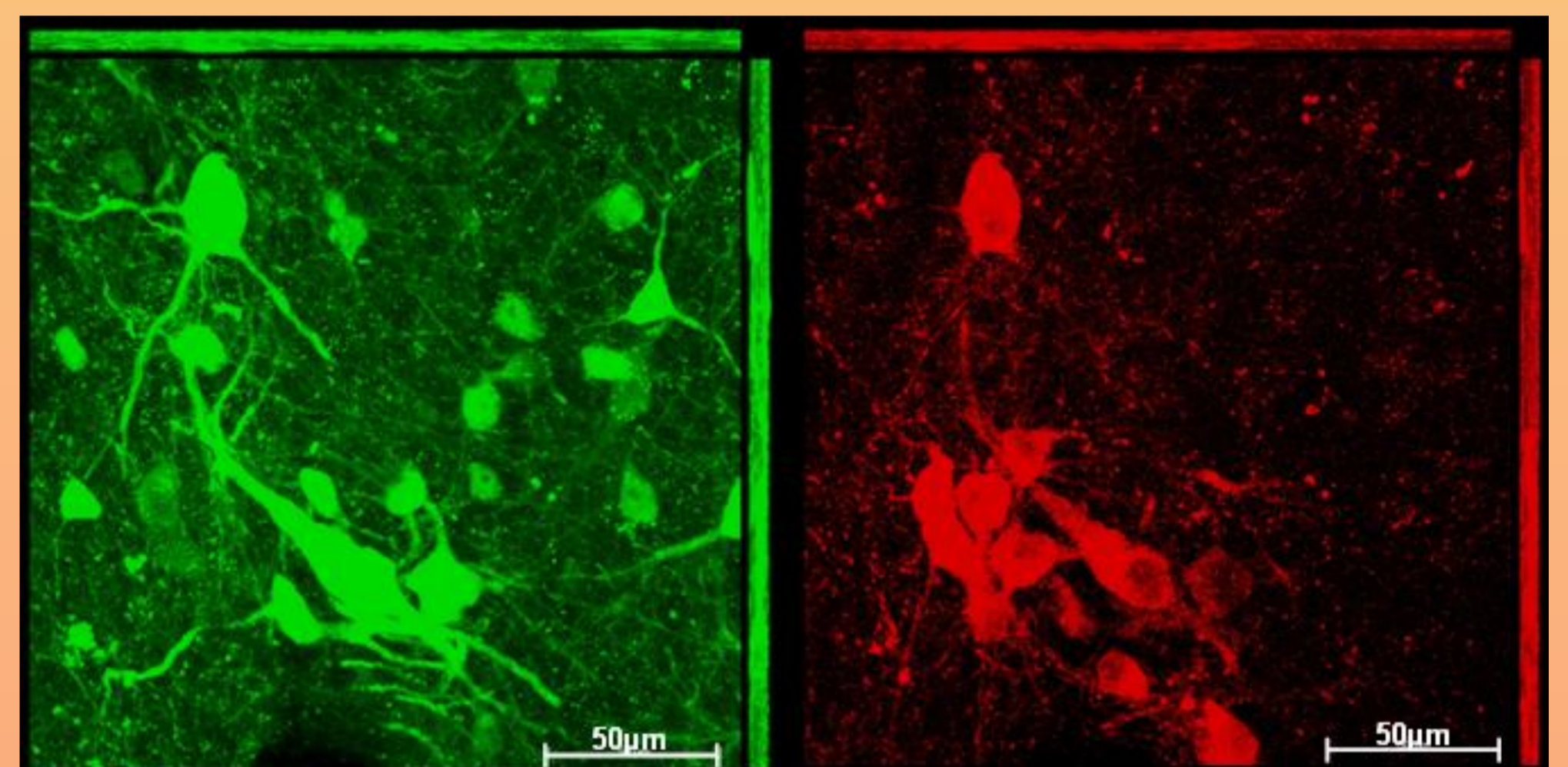


Figure 1. Confocal images of mice vestibular efferents immunopositive for GFP (green) and the cholinergic marker ChAT (red).

Results III

Kv4.3 is expressed post-synaptically in olivocochlear efferents and LSO principal cells.

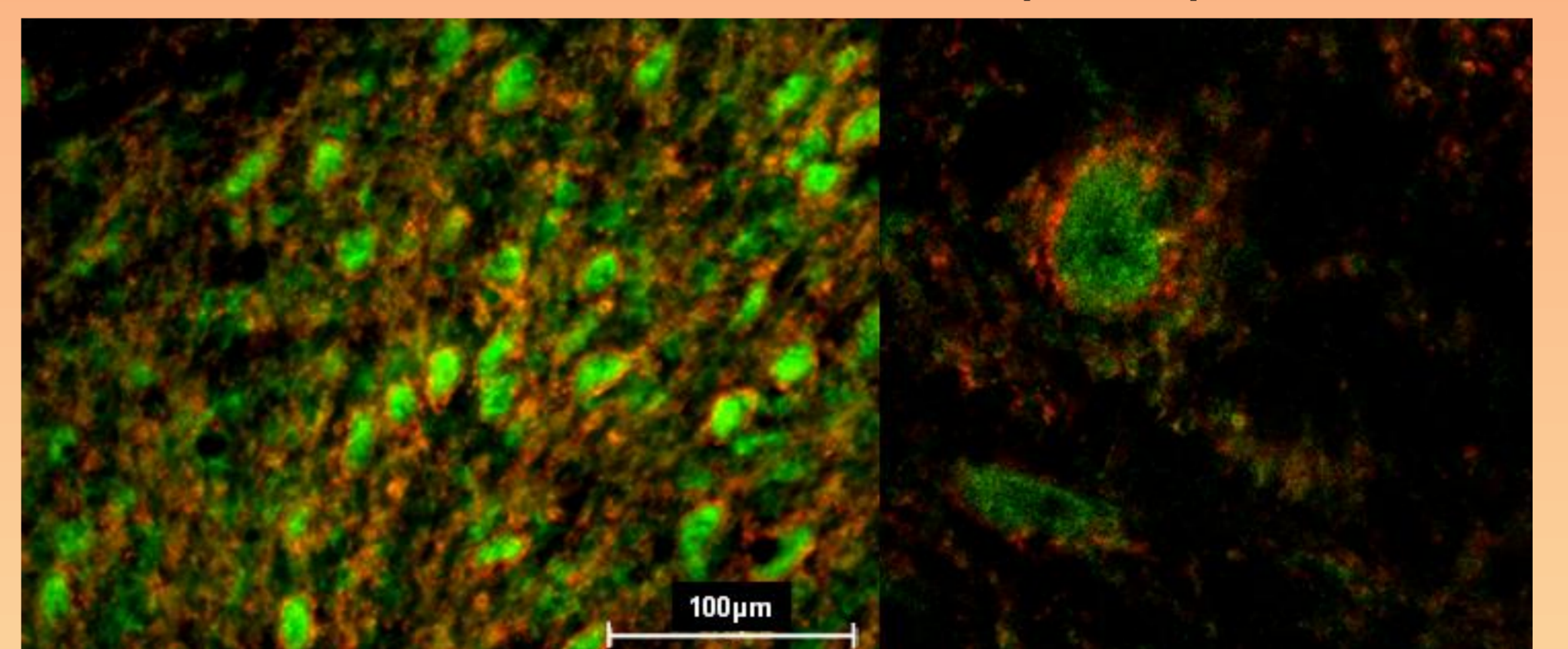


Figure 3. Confocal images of adult rat LSO labelled against Kv4.3 (green) and the pre-synaptic neuronal marker SV2A (red). Enlarged image is processed with parallel iterative deconvolution.

Acknowledgements

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