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Time-dependent changes in eye-specific segregation in the dorsal lateral geniculate nucleus and superior colliculus of postnatal mice

Key words: Eye segregation, Dorsal lateral geniculate nucleus (dLGN), Superior colliculus, Mouse visual system

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Introduction

- There are two major pathways from retinal ganglion cells (RGCs) in the mouse visual system. One pathway goes to the dorsal lateral geniculate nucleus (dLGN), namely the retinogeniculate pathway. The other goes to the superior colliculus (SC), namely the retinocolliculus pathway.
- RGC axons from the two eyes are segregated into distinct areas, forming eye-specific domains in both dLGN and SC.
- In this paper, we explore the development of eye-specific projection patterns in both dLGN and SC within the first three postnatal weeks.
- Our results provide a reference for eye-specific maps of mice.

Features of our method

– Intravitreal injection

Alexa fluor488- and fluor555-conjugated cholera toxins were injected into the left and right eyes.

– Image acquisition

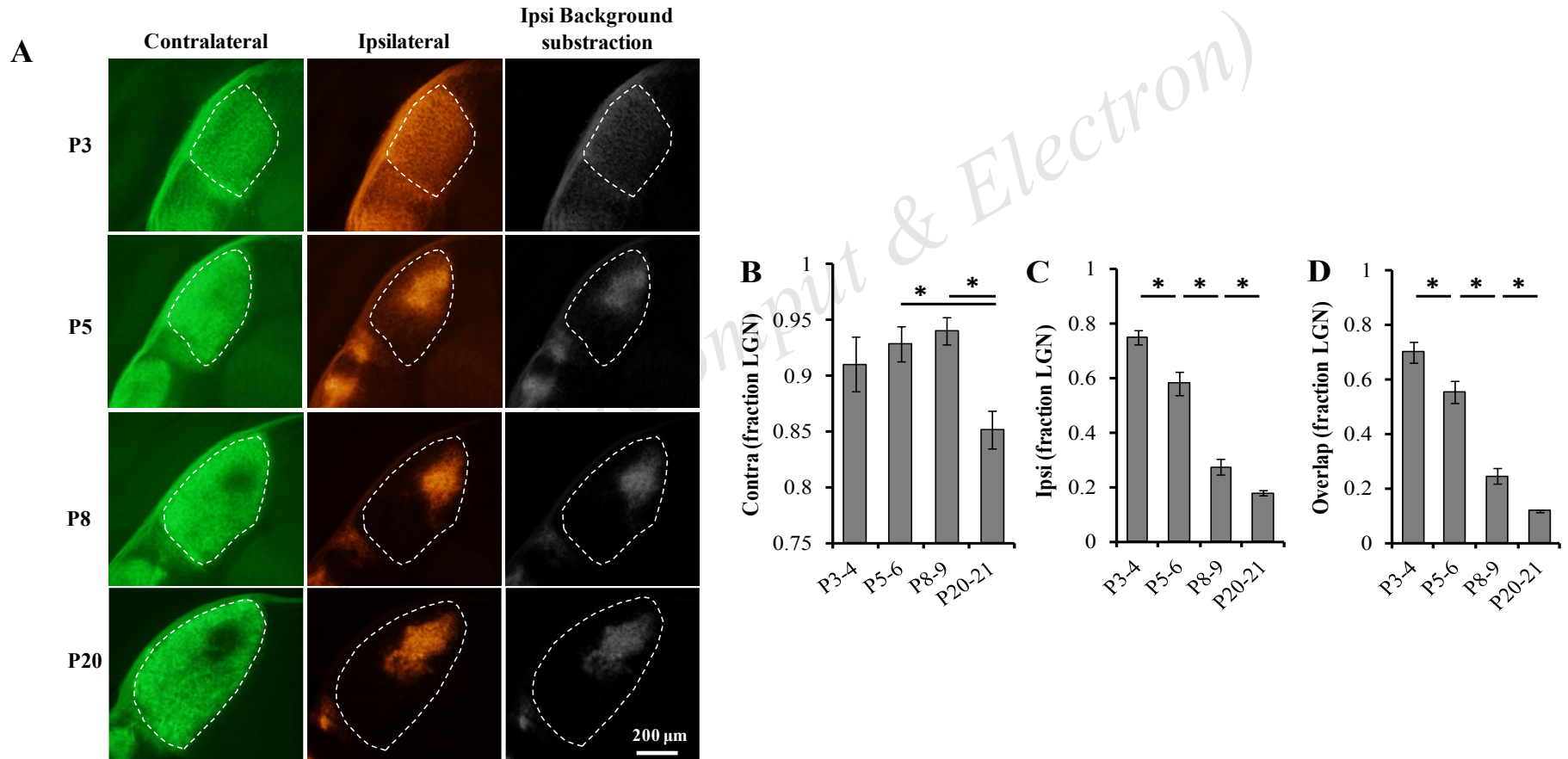
The fixed brains were sectioned into 100 μm slices for dLGN examination in the coronal direction and 120 μm slices for SC examination in the sagittal direction using a vibratome machine.

– Image analysis

All images were background subtracted using ImageJ. Contralateral and ipsilateral fractions were calculated using a custom Matlab program.

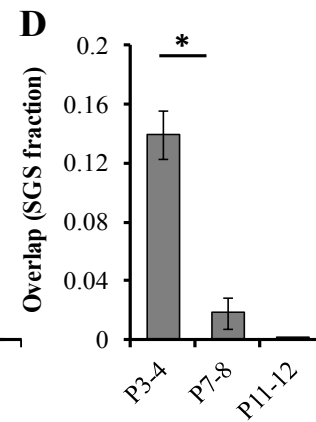
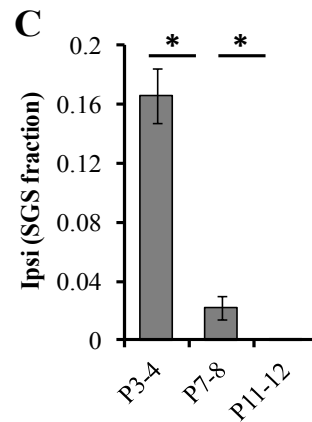
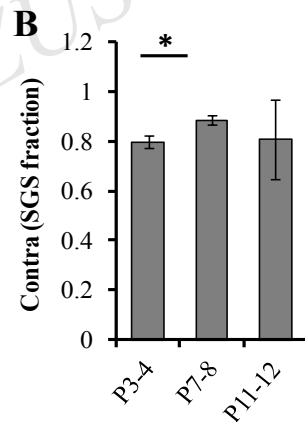
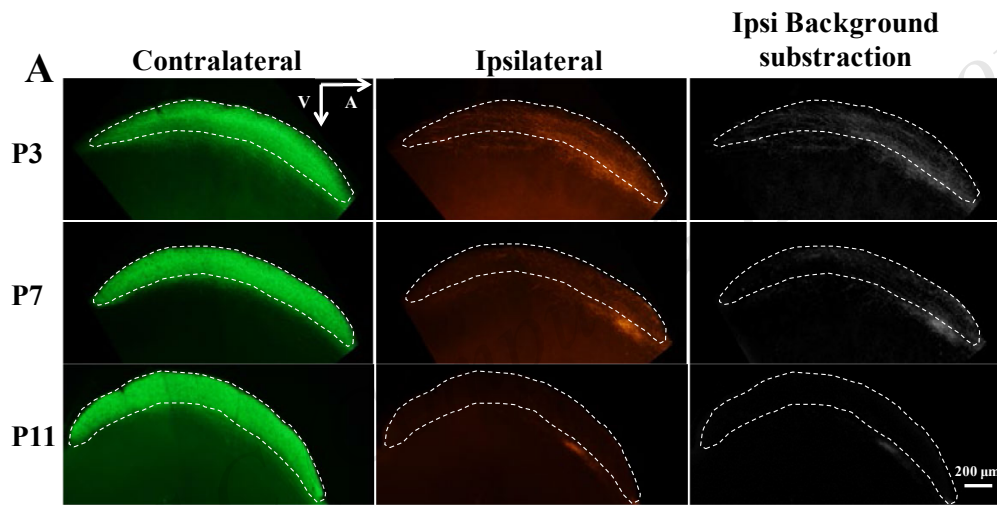
Major results (I)

Retinogeniculate axons from the two eyes segregate over time



Major results (II)

Development of eye-specific segregation in the SC



Conclusions

- Our experiments demonstrated that there are two stages during the course of development of eye-specific segregation in dLGN: a rapid stage of pattern formation (P3–P9), followed by a slow stage of further segregation (P9–P21).
- In SC, the ipsilateral fractions decreased and the contralateral fractions changed only slightly between P3 and P12.
- The development of eye-specific segregation in SC was faster than in dLGN. Moreover, the ipsilateral fractions in SC were much smaller than those in dLGN.