But what do they see?

Functional consequences of abnormal visual system topography in ephrin-A$^{-/-}$ mice

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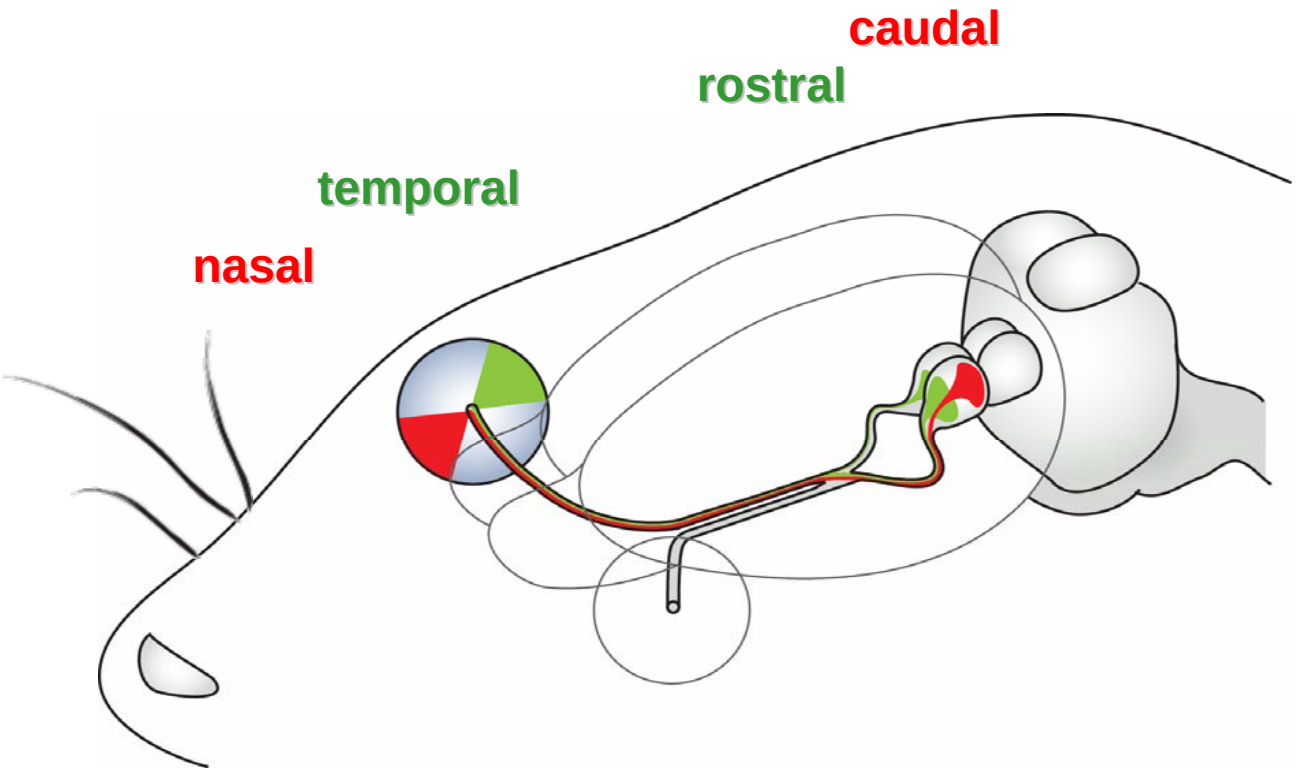
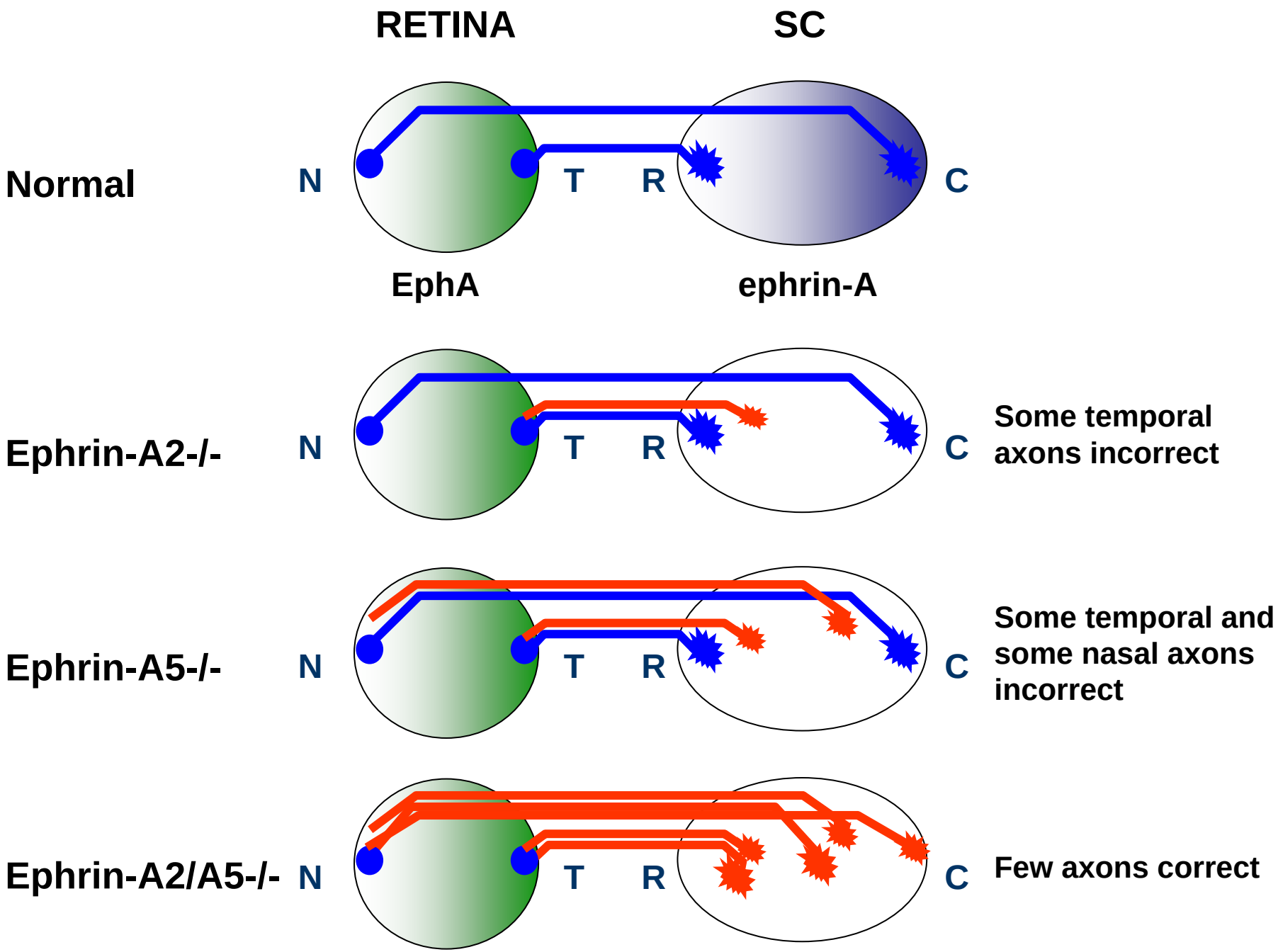
The visual system



Topographic organisation


RETINA
SC
Normal
N
T
R
C
EphA
ephrin-A
Ephrin-A2-/-
N
T
R
C
Some temporal axons incorrect
Ephrin-A5-/-
N
T
R
C
Some temporal and some nasal axons incorrect
Ephrin-A2/A5-/-
N
T
R
C
Few axons correct

Visually-evoked behaviour

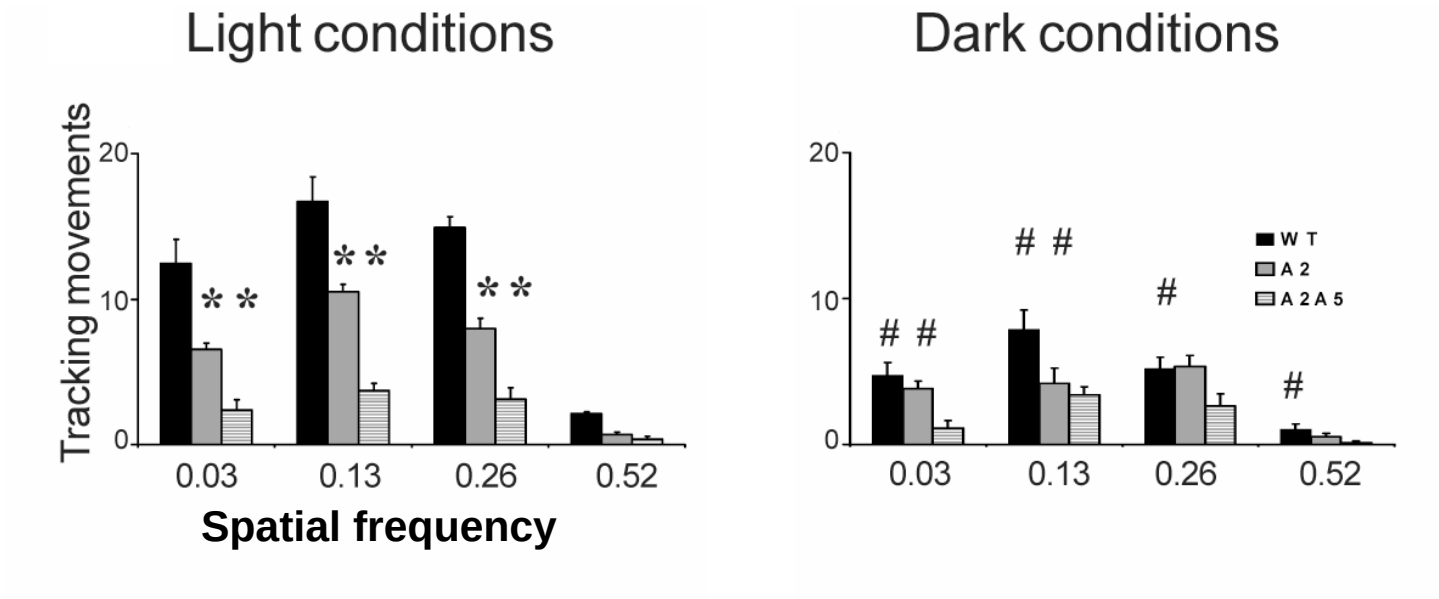
- Placing response
- Visuomotor response
- Pupillary mobility
- Visual acuity

Visual pathways

- Retino-collicular projection
- Retino-pretectal projections
- Ipsilateral and contralateral projections

Visuomotor response:

Head tracking movements in response to moving stripes



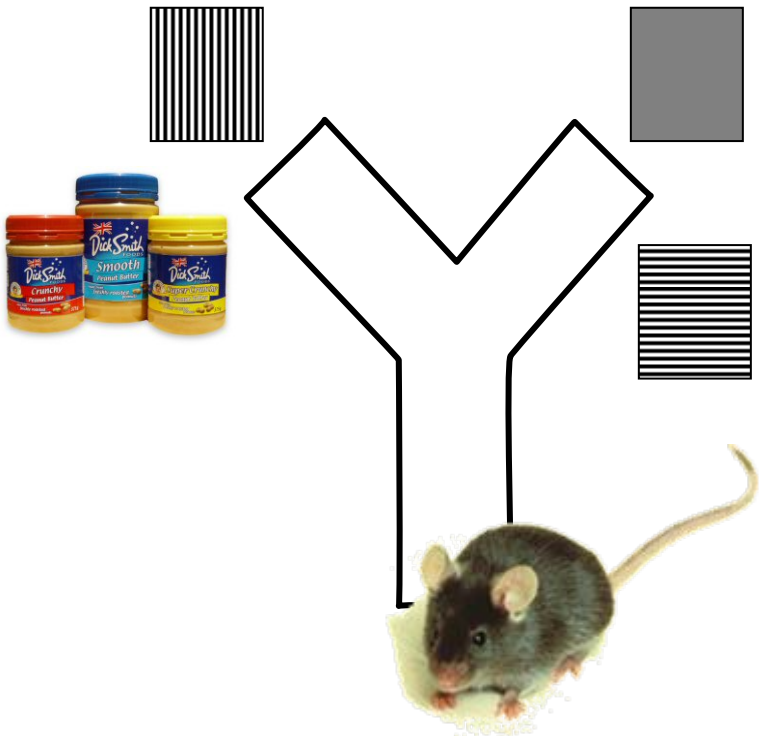
Lack of sensitivity to light?

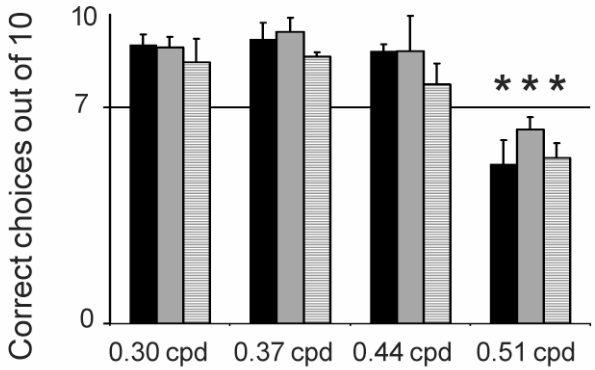
Pupillary mobility, light dark avoidance tests

Reduced visual acuity?

Visual acuity

Forced choice learning task





Visually-evoked behaviour

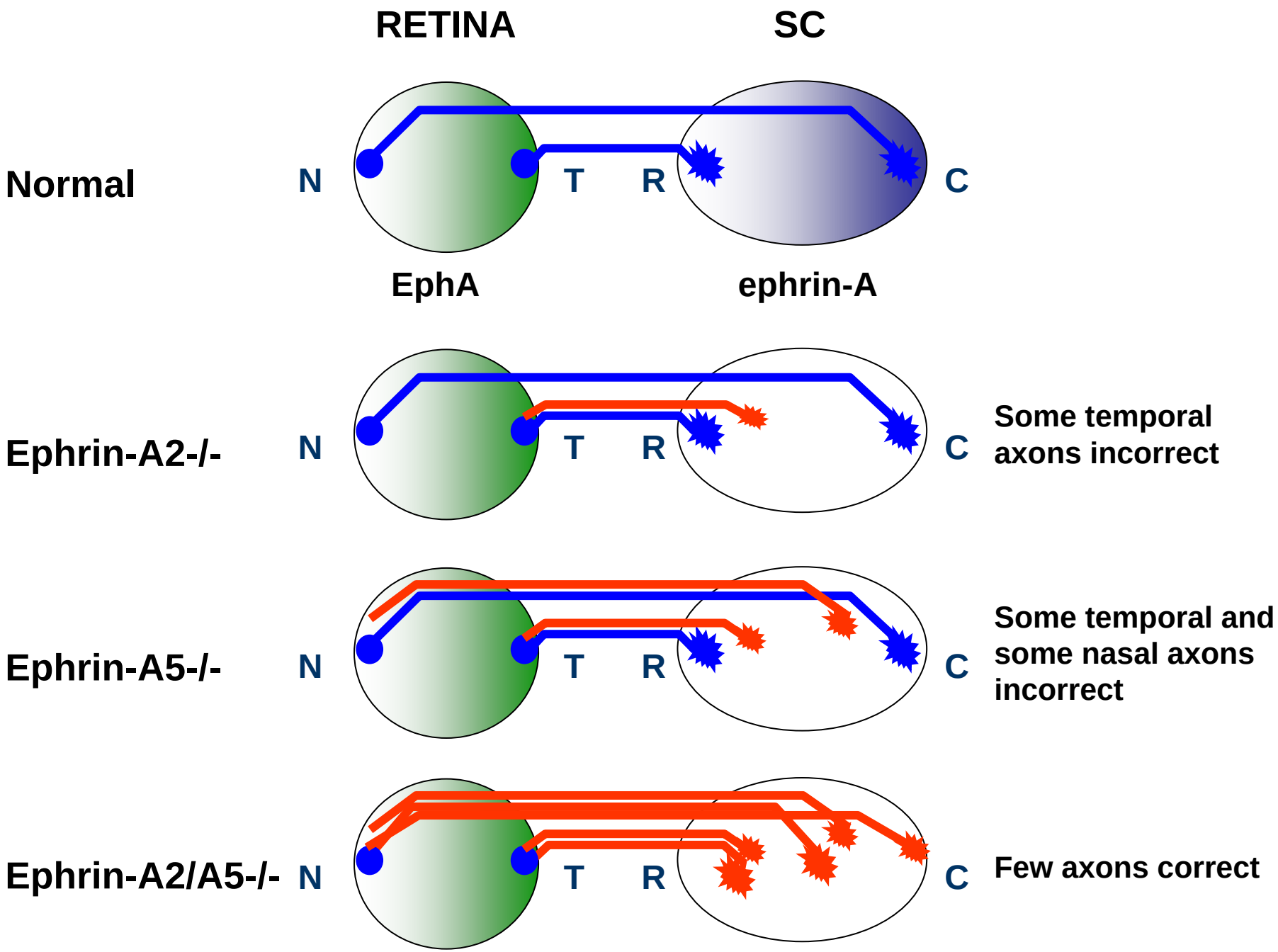
Normal:

- **Placing response**
- **Pupillary mobility (pretectal, non-topographic)**
- **Visual acuity (geniculocortical)**

Abnormal:

- **Visuomotor response**

(pretectal, superior colliculus, binocular, but also tecto-olivary, cerebellar, neck muscles…)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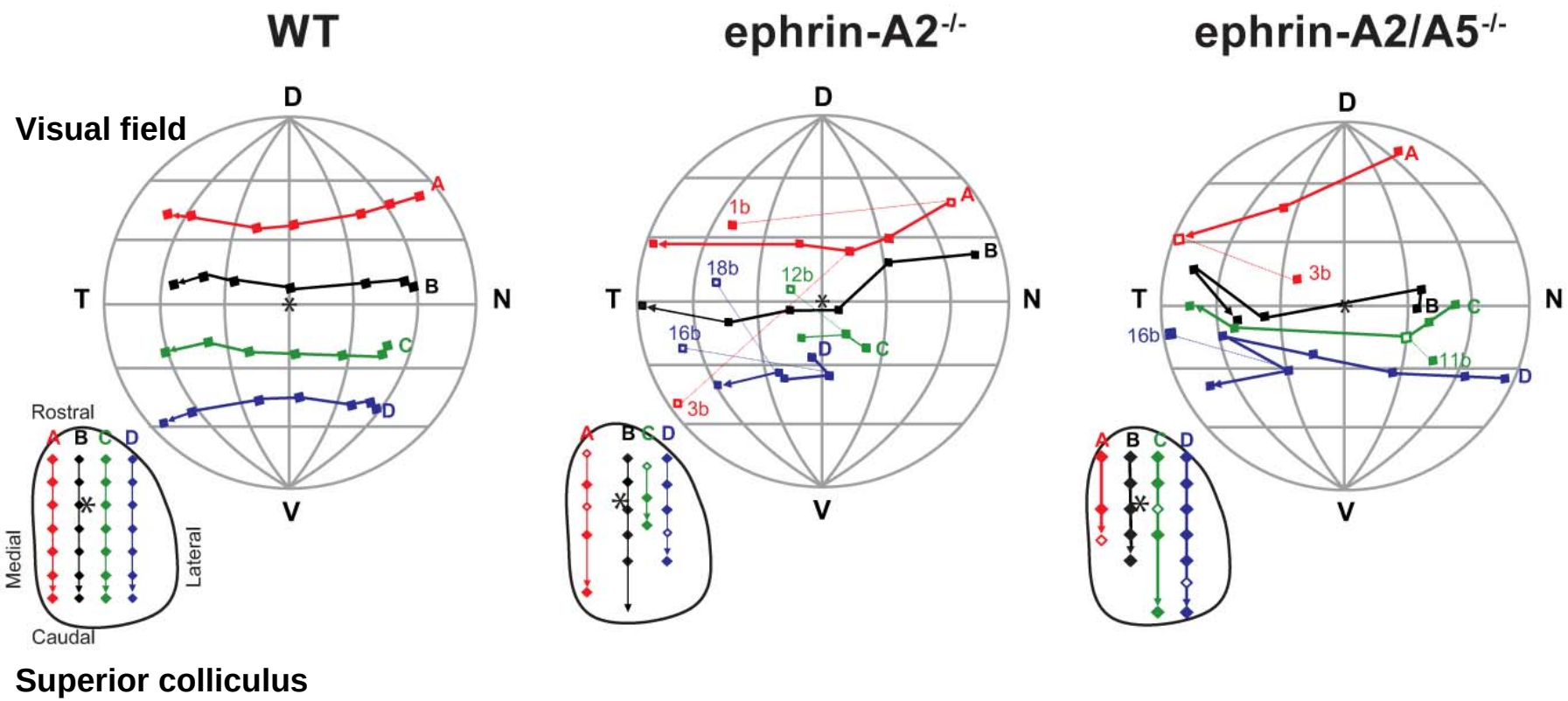
Few axons correct

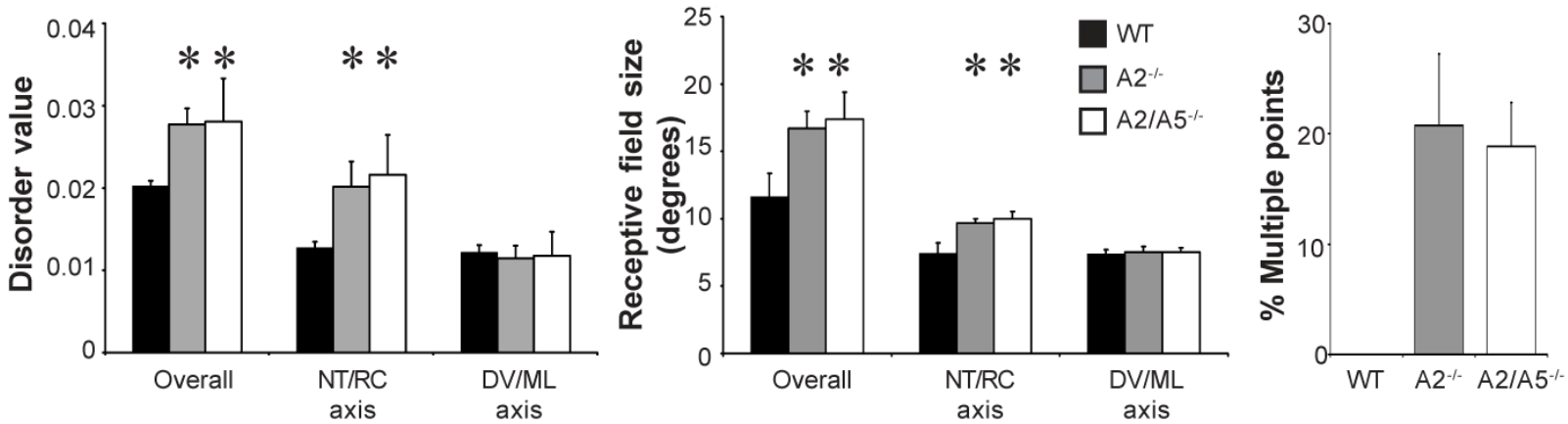
Electrophysiological mapping



- Supernumerary non-topographic projections can evoke a collicular response
- The “strongest” RF is not necessarily the most topographically appropriate
- Similar amount of functional disorder in ephrin-A2-/- and ephrin-A2/A5-/- mice

Quantification of disorder

- **Calculated the predicted location of RF based on the electrode recording location**
- **Disorder value represents the distance between predicted and actual RF location**

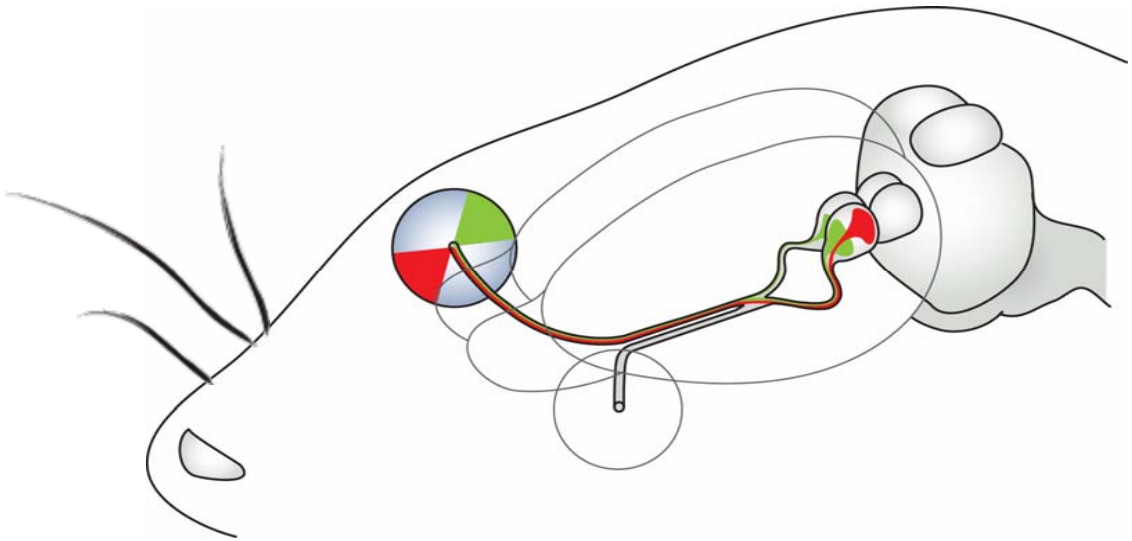


Non-correlation between visually evoked behaviour and functional retinocollicular topography:

Behaviour:
WT > ephrin-A2-/- > ephrin-A2/A5-/-

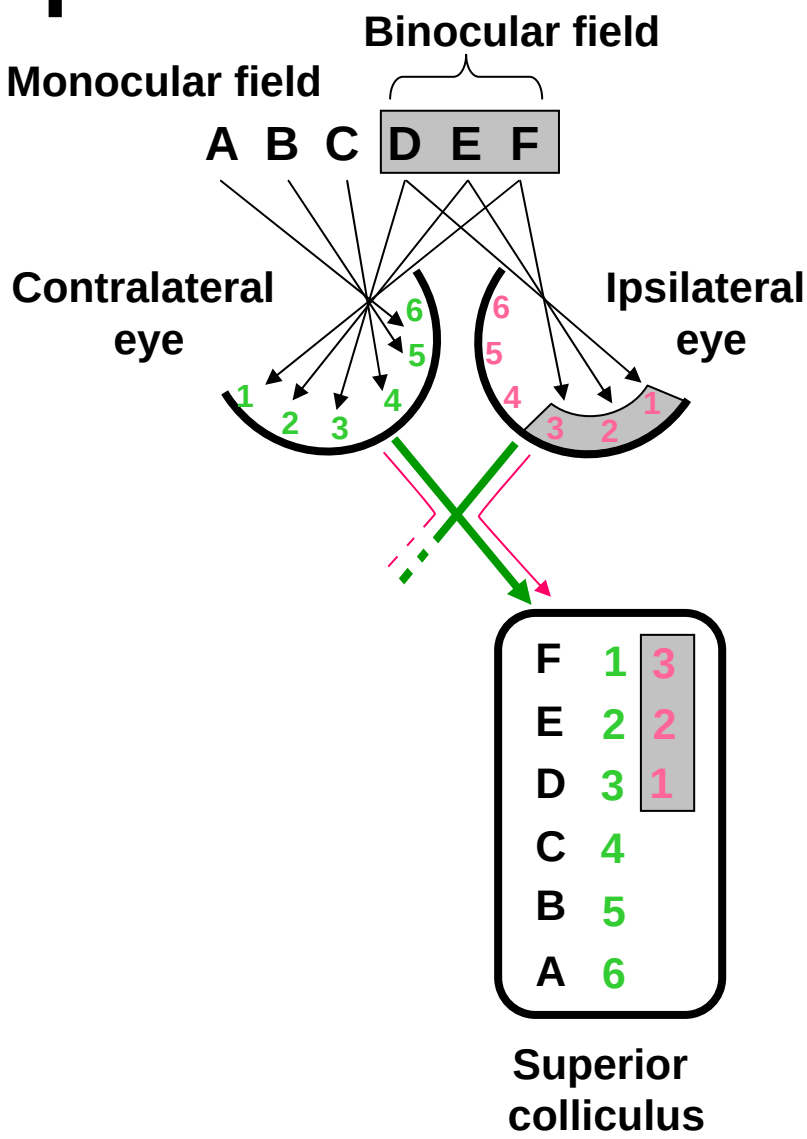
Functional topography:
WT > ephrin-A2-/- = ephrin-A2/A5-/-

Binocular input

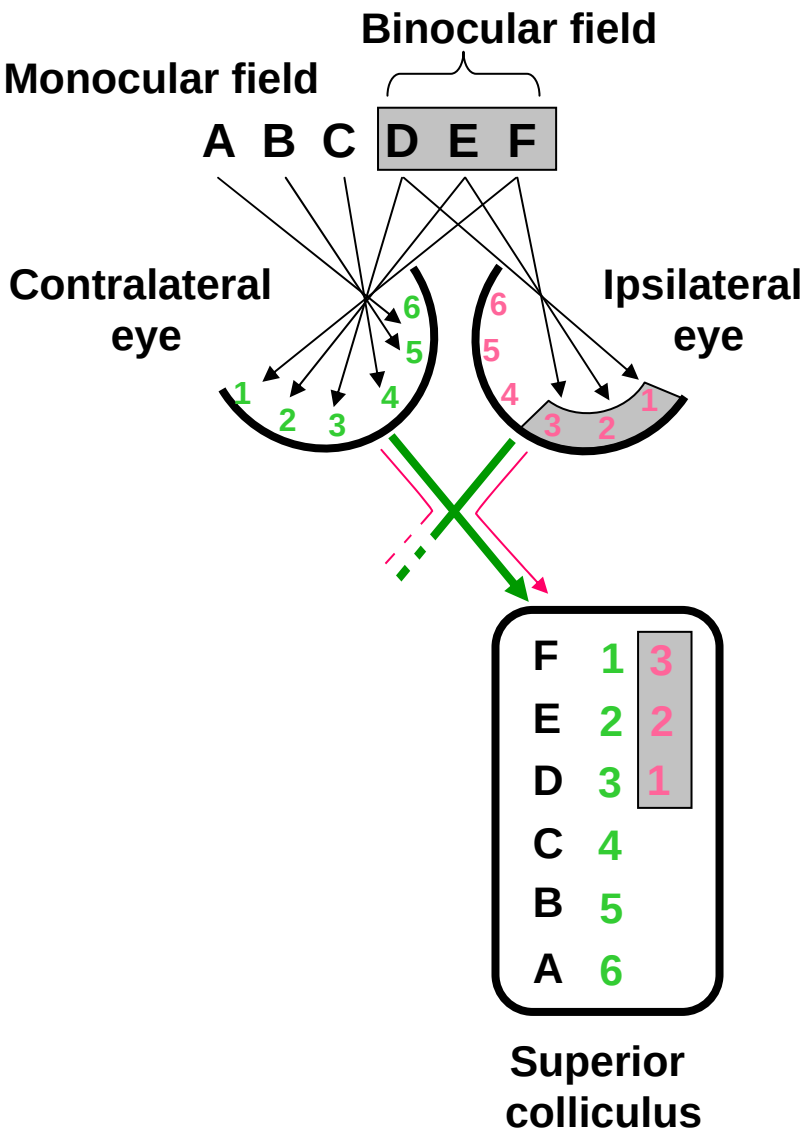


Less than 10% of RGCs, project to rostral 1/3rd of the SC

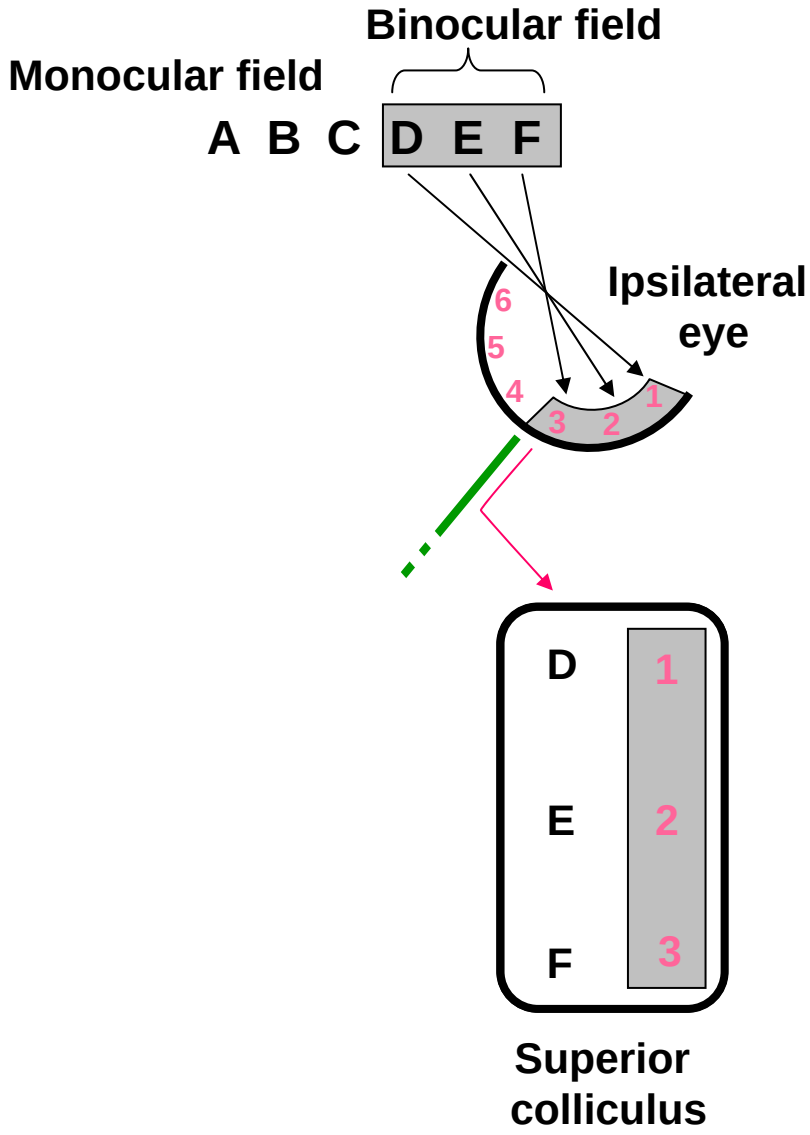
Binocular input



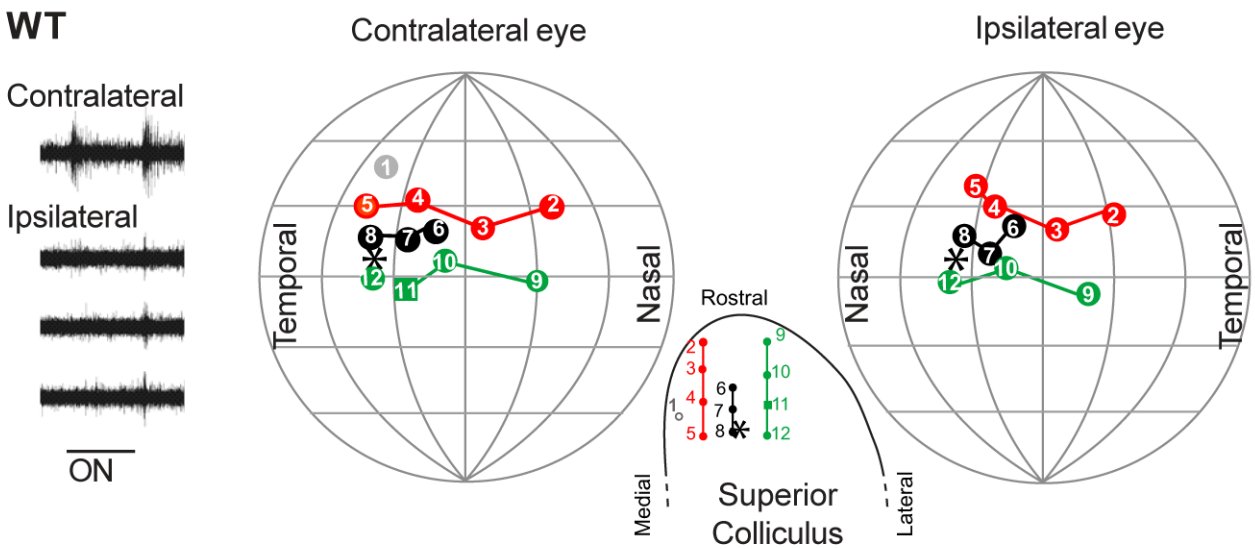
Intact visual system

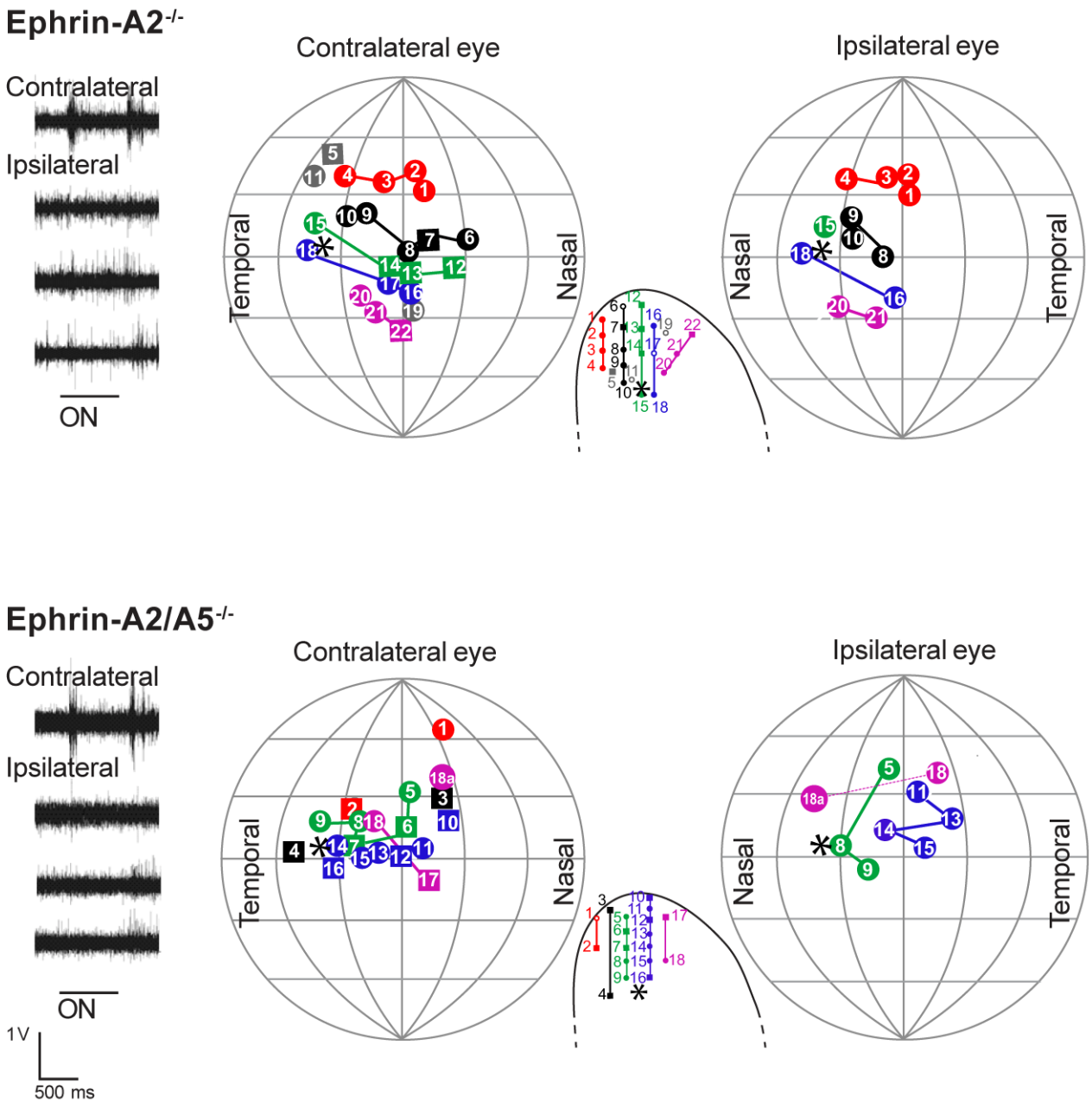


Monocular enucleation



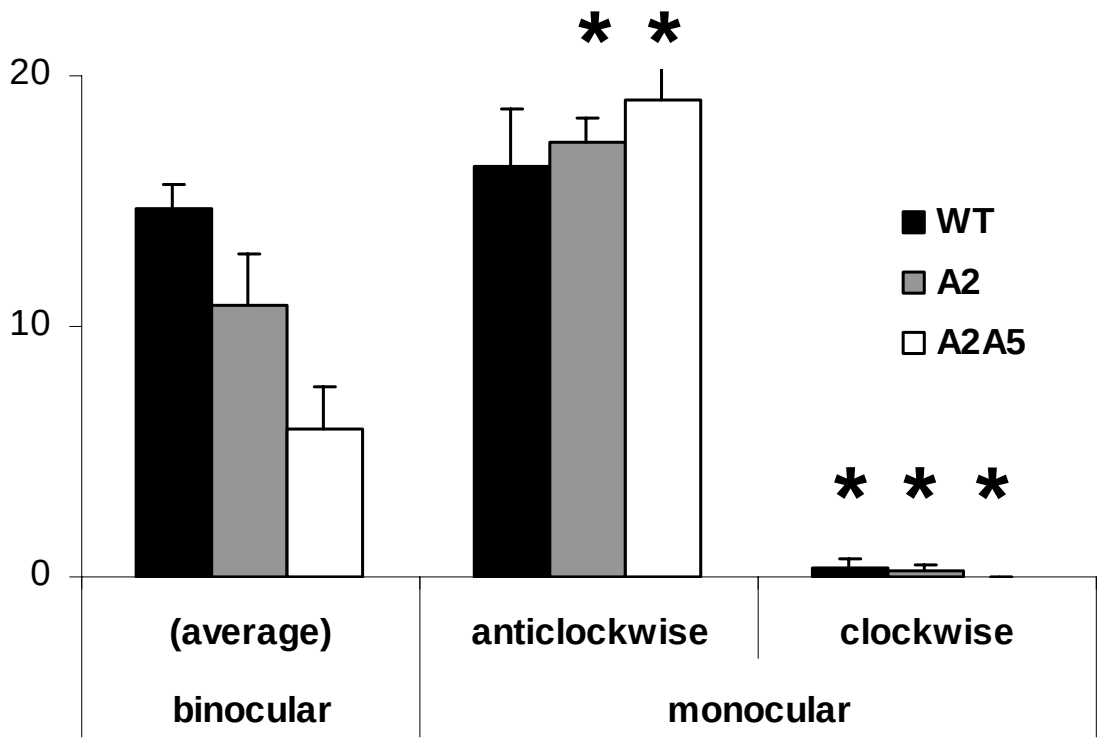
Relationship between contralateral and ipsilateral input




Ephrin-A2-/-
Contralateral
Ipsilateral
ON
Contralateral eye
Ipsilateral eye
Temporal
Nasal
Nasal
Temporal
Ephrin-A2/A5-/-
Contralateral
Ipsilateral
ON
1V
500 ms
Contralateral eye
Ipsilateral eye
Temporal
Nasal
Nasal
Temporal

Visuomotor response

Monocular occlusion (left eye)



Light conditions, 0.32 cpd

Comparing anatomical and functional topography: Limits of activity dependent refinement?

Integration of binocular input: role for ephrin-A5?

Other projections to the SC?

Acknowledgements

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