Computational models for understanding development of retinotopic maps

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Background

Slides

Available at: `http://bit.ly/eglen-nijmegen`

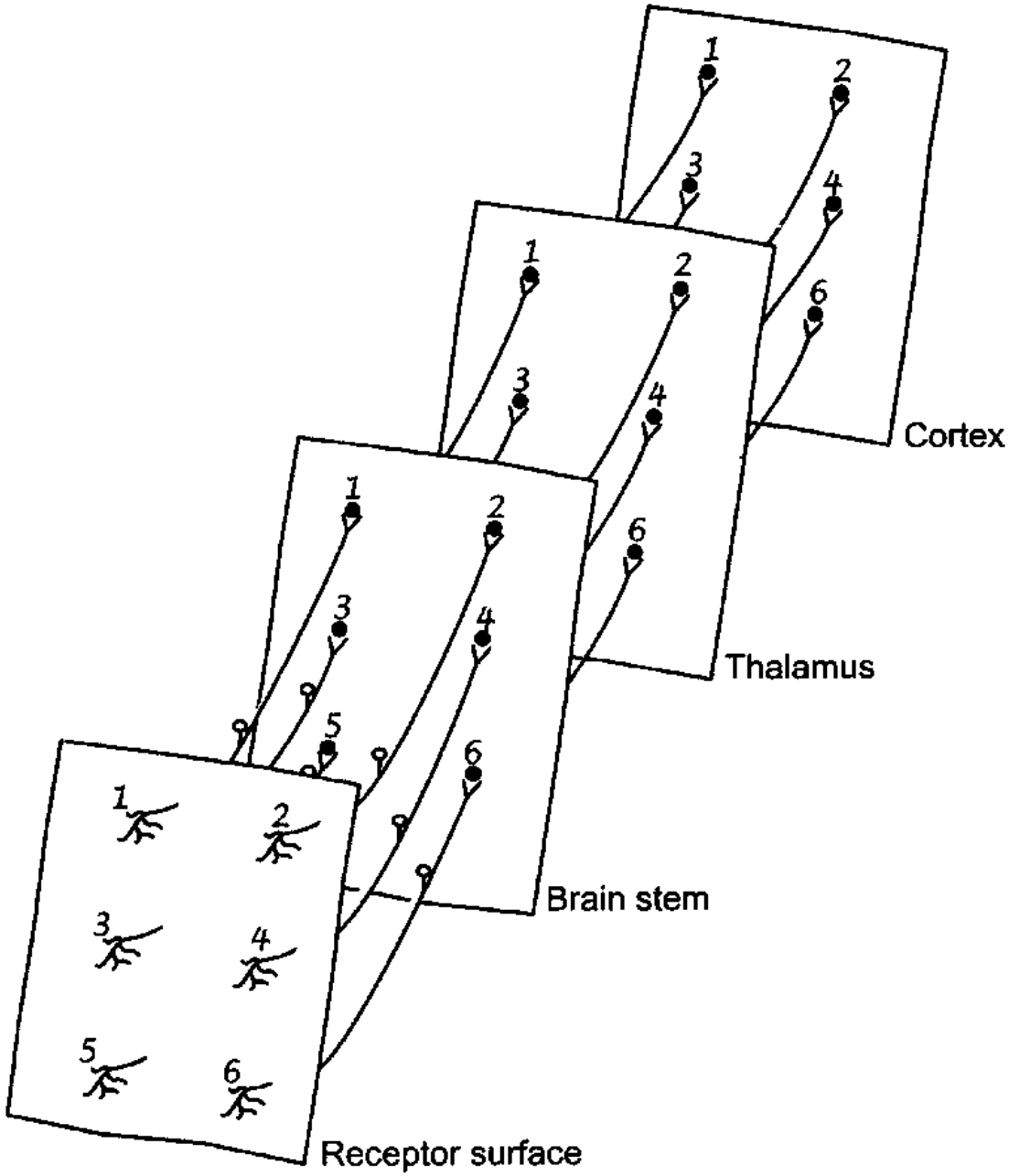
References

Available at: `http://bit.ly/eglen-n-refs`

Acknowledgements

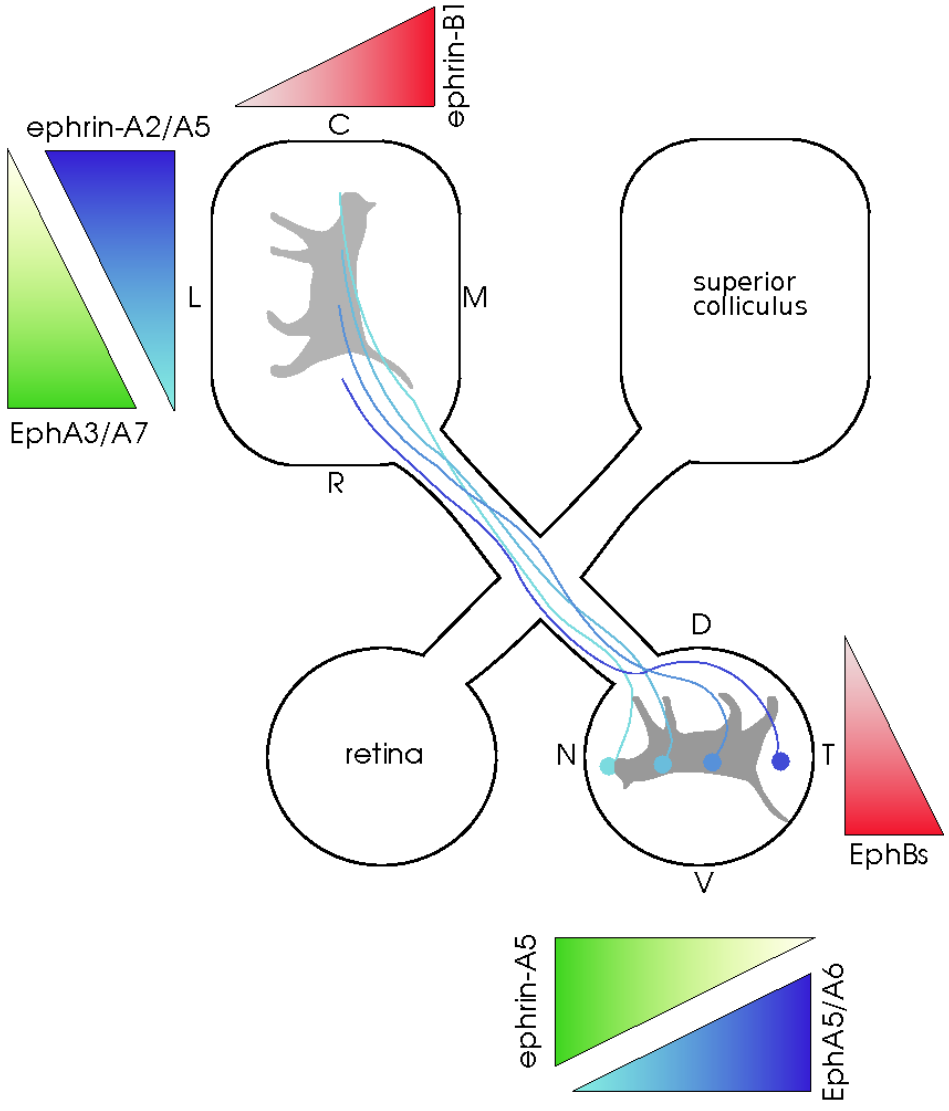
Catherine Cutts, Johannes Hjorth, David Sterratt, David Willshaw. Paperpile.

What is a topographic map?



(Kaas, 2002)

What is a retinotopic map?



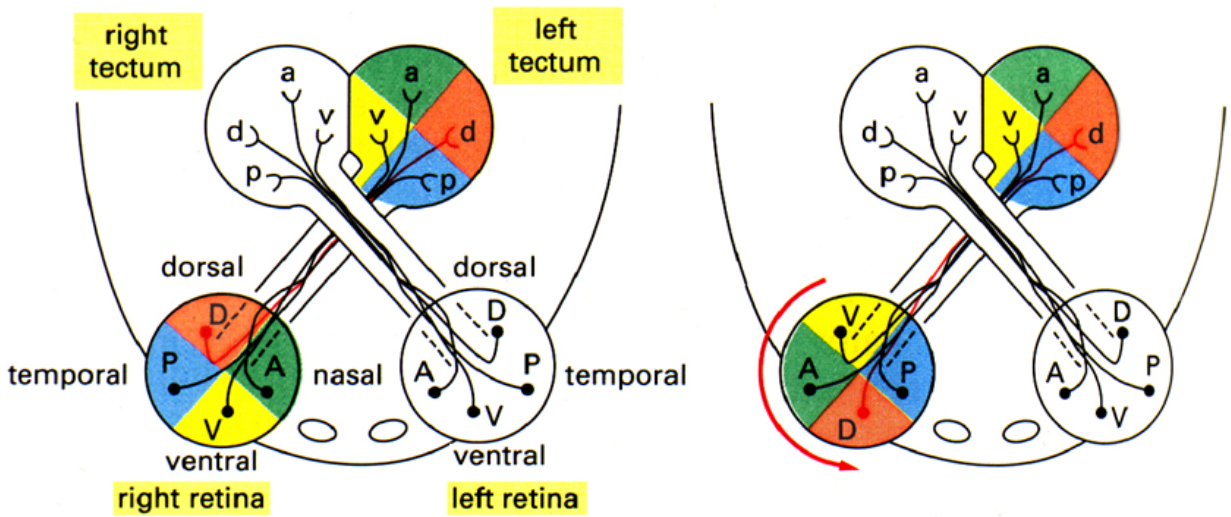
Sperry's experiments

Sperry's experiments:

1) Rotation of the eyes of a newt or frog by 180°.

2) Cutting of the optic nerves prior to rotation of the eyes by 180°.

In both experiments the animals see their world upside down and back to front. This condition is irreversible.



Result of rotation

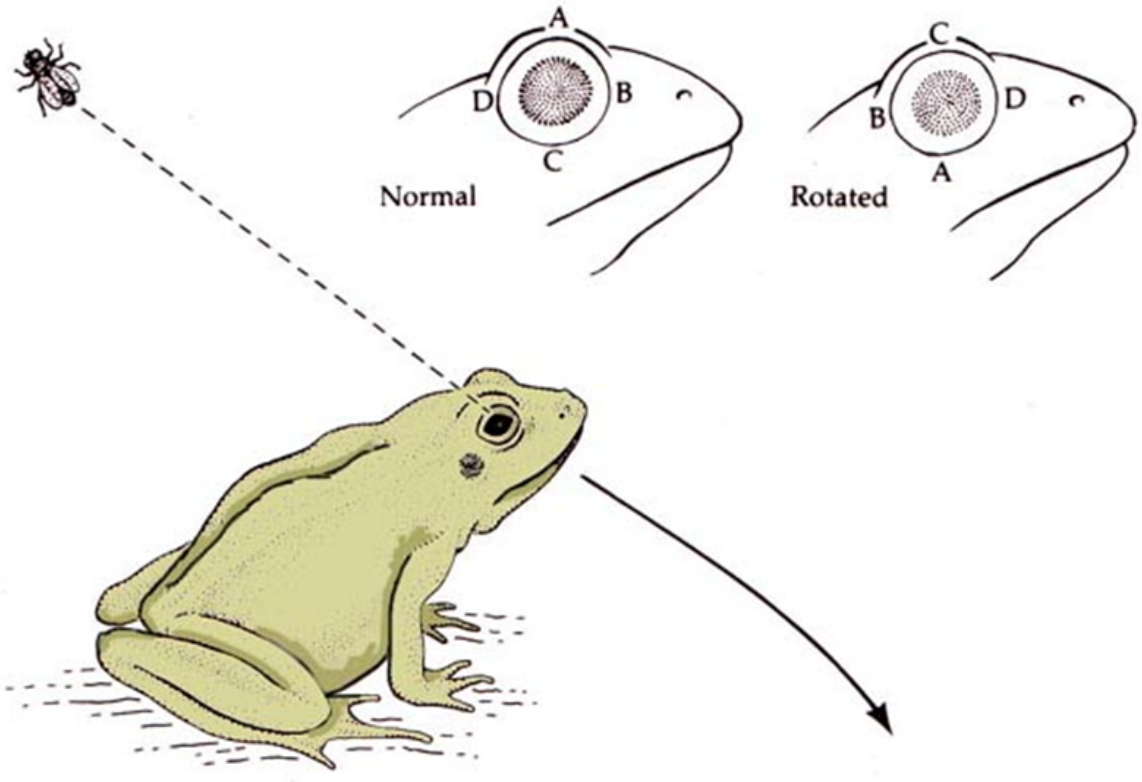
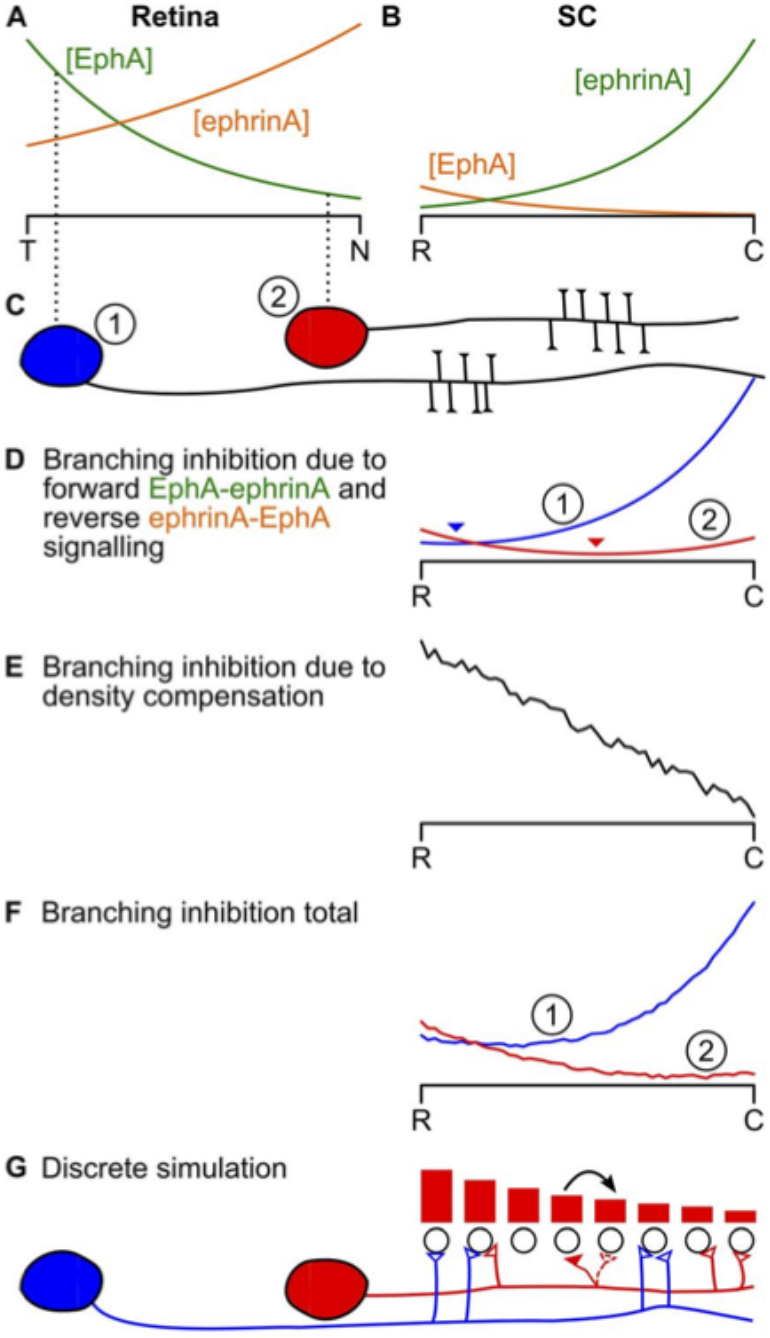


Fig. 21. When the eye is rotated 180¡, the frog's prey catching behavior is inverted. (after Sperry, 1956).

Energy-model for branching (Gierer 1987; Sterratt 2013).



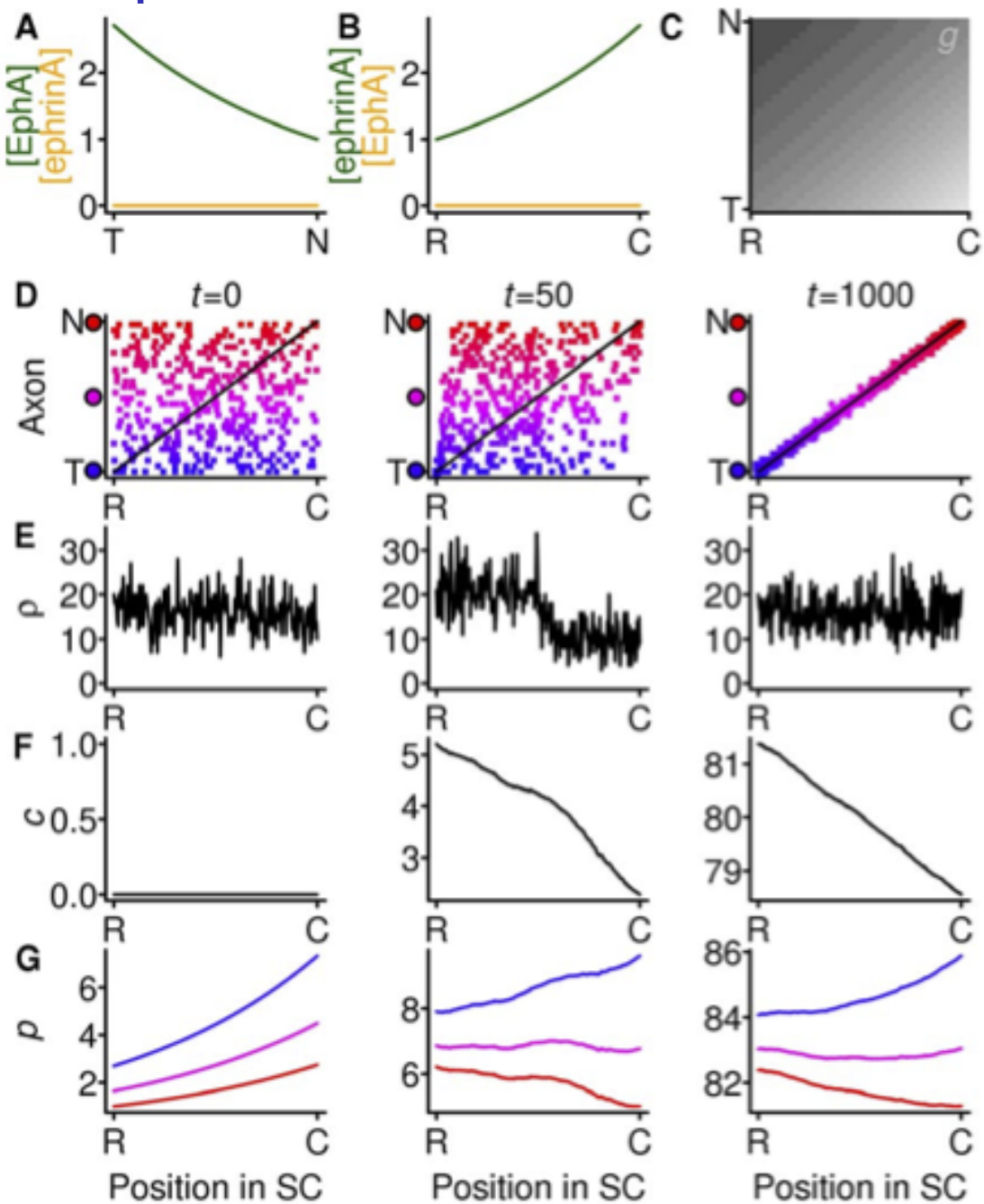
$$g(x,u,t) = [EphA](u)[ephrinA](x) + ephrinA^*(u)[EphA^*](x)$$

$$\frac{\mathrm{d}c}{\mathrm{d}t} = \epsilon p(x,t) - \eta c(x,t)$$

$$p(x,u,t) = g(x,u,t) + c(x,t)$$

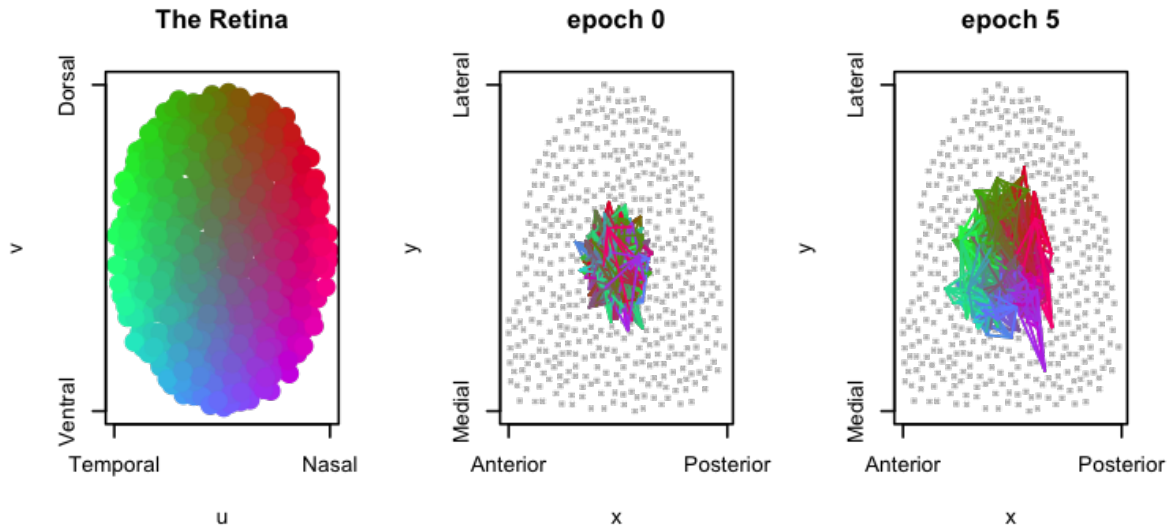
(Sterratt 2013)

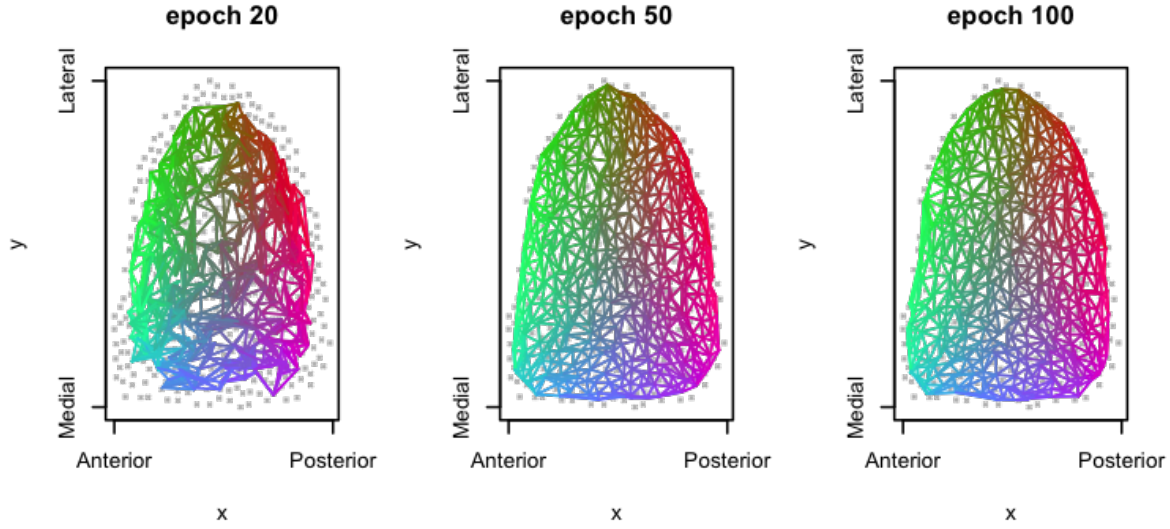
Wild-type development: 1D



(Sterratt 2013)

Wild-type development: 2D





Activity-based model (Willshaw and von der Malsburg)

Competition brings together lots of models.

refs to add

kaas2002