HIGHLIGHTS

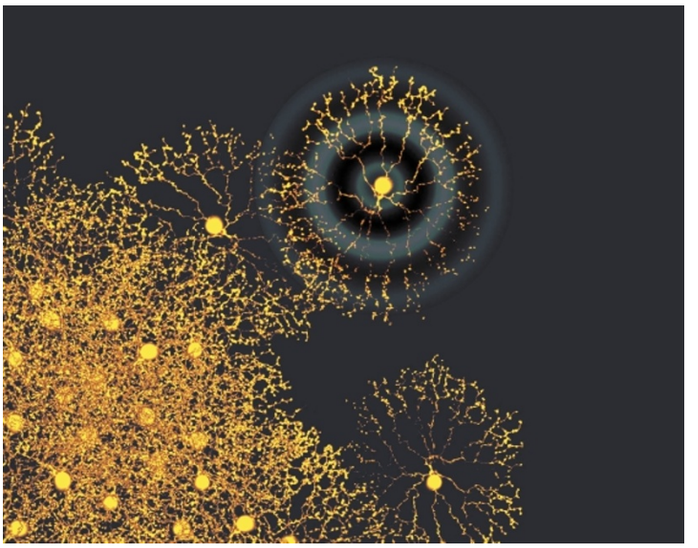
VISUAL PROCESSING

Seeing stars

The old problem of how ganglion cells in the retina detect the direction of motion of a visual image comes a step closer to a solution with findings from Euler *et al.*, described in *Nature*. The secret, it seems, lies in local computations carried out in the dendrites of specialized interneurons called starburst amacrine cells.

Directional sensitivity is a fundamental property of the visual system, and it arises very early in the visual pathways. A large number of the retinal ganglion cells that carry visual information from the retina to the brain respond preferentially to stimuli that move in a specific direction. But it has been unclear whether this information is computed in the ganglion cells themselves or earlier in the retinal circuitry.

Directionally sensitive ganglion cells receive rich inputs from starburst amacrine cells. These interneurons are symmetrical and highly branched. Each branch carries both inputs and outputs; the inputs come from excitatory synapses all along the branches, but the output synapses with the ganglion cells are found only on the distal parts of the branches. This geometry led to the suggestion that stimuli moving outwards along a branch would give rise to more transmitter release than those moving inwards towards the cell body. If this were true, and if branches connected to ganglion cells with preferred directions that corresponded to the branch direction, it would explain how the ganglion cells can show direction selectivity.



Starburst amacrine cells in the retina. Courtesy of Thomas Euler, Max Planck Institute for Medical Research, Heidelberg, Germany.

To study the events within individual starburst cell branches, Euler *et al.* used optical imaging of the retina. They injected starburst cells with a calcium-sensitive dye, so that local changes in calcium concentration could be seen by two-photon microscopy. They found that visual stimulation with wedge-shaped light sources over just one segment of the starburst cell's arborization led to local rises in calcium in just the illuminated branches.

So, do the dendrites show direction sensitivity? The authors tested local responses to moving gratings and bars, and found that the branches did show larger responses for movement away from the cell body than for movement towards it. The results of further recordings indicate that the computation occurs locally within each dendrite. If it can be shown that the different branches connect to ganglion cells with different preferred directions, we might be close to understanding this fundamental property of retinal processing.

Rachel Jones

References and links

ORIGINAL RESEARCH PAPER Euler, T. *et al.* Directionally selective calcium signals in dendrites of starburst amacrine cells. *Nature* 4 August 2002 (doi:10.1038/nature00931).

WEB SITES

Euler's lab: http://sun0.mpimf-heidelberg.mpg.de/~teuler/index.html