



Figure 1 Cells in the primary visual cortex are sensitive to particular orientations of the visual stimulus: for example, cells that respond well to stimuli that are presented vertically (blue) do not respond to horizontally orientated stimuli (yellow). The orientational bias of cortical cells is built on the inputs from on- and off-type channels from the retina and the relay centre, the dorsal lateral geniculate nucleus (LGN). Within the cortex, cells with a similar orientational bias are distributed in a patchy but systematic configuration, forming orientation maps. Weliky and Katz¹ now show that the mechanisms that form these maps are not affected by electrical messages that come from the retina during development (adapted from a figure by L. C. Katz).

lus is ineffective when it is vertically orientated. Considerable effort, both experimental⁴⁻⁷ and theoretical⁸, has gone into trying to work out how cells in the developing and adult visual cortex acquire their 'orientation preference'. Although the wiring of connections that underlie this property remains elusive, orientational bias seems to require inputs from on-centre and off-centre-type retinal neurons². On-centre and off-centre responses are evoked when retinal projection-neurons are stimulated, or suppressed, respectively, by light onset. In mammals, the two responses are communicated as separate channels of information from the retina to a relay centre in the brain (the dorsal lateral geniculate nucleus). They are then combined at the level of the cortex, to shape the electrical responses of cortical neurons (Fig. 1).

Hubel and Wiesel¹ not only showed the orientational bias of cortical cells in response to light; they also found that cells with the same orientation preference are organized into patches that show a repeating pattern across the surface, and within the depth, of the cortex. This pattern gives rise to what is known as the 'orientation map' (Fig. 1), which is easily viewed using optical recording techniques. These provide images of the spatial distribution of activity in response to stimulation, at the cortical surface of the living animal⁵⁻⁷. In studying how these spatial patterns are set up during development, Weliky and Katz¹ have asked whether the mechanisms that shape the

orientation preference of individual cortical cells also dictate their spatial organization.

One such mechanism may be that of electrical activity, which is crucial for establishing specific patterns of connections in other parts of the visual system⁹. Visual experience is thought to set up the orientational bias of cortical cells but, although activity is important, visual experience itself may not be vital^{4,6,7}. However, until now it was unclear whether activity *per se*, or specific temporal patterns of activity, plays the instructive role.

Theoretical studies indicated that distinct temporal patterns of activity influence the final organization of neuronal connections during development⁸. To test this, the aim has been to manipulate the pattern of endogenous activity that is delivered to the cortex during the period when visual connections are formed. One way to do this is to artificially stimulate the optic nerve to produce patterns of synchronous or asynchronous activity that are not normally present¹⁰. Now, with much perseverance and technical finesse, Weliky and Katz¹ have chronically stimulated the optic nerve, and artificially synchronized the activity of on and off inputs to the visual cortex during the period of development when orientation tuning and map formation takes place.

The results obtained by Weliky and Katz

elegantly show that although the orientation tuning of cortical cells is weakened by artificial synchronization, orientation maps still develop. Kim and Bonhoeffer⁶ have already shown that orientation maps are resilient to changes in activity patterns after their initial formation, but Weliky and Katz have extended these interventions to the developmental period before orientation maps appear. They have shown that, even then, specific patterns of activity do not seem to be crucial for this unique pattern of connectivity to emerge.

What do these results really tell us about how the brain organizes its connectivity patterns during development? The important message from the new work is that the mechanisms that confer a particular physiological property on a cortical neuron do not necessarily ensure that its immediate neighbours are treated similarly. Stereotypic arrangements such as orientation maps may be intrinsic to the cortex (perhaps they are dependent on local connectivity patterns within the cortex^{8,9}), and they are undisturbed by the electrical messages that are conveyed from the retina during development. This contrasts with the formation of ocular dominance columns in the cortex, which depends highly on input activity⁹. ▶

Animal locomotion

The cheetah's time has come

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Everyone knows that the cheetah (*Acinonyx jubatus*), shown here in full flight, is the fastest land animal. So a report by N. C. C. Sharp (*J. Zool.* 241, 493–494; 1997) claiming to provide the first accurate measurements of the cheetah's running speed comes as something of a surprise. Moreover, the timing was done as long ago as 1965.

Apparently, for many years after Sharp made the measurements, he was unaware of the inaccuracy of previous studies. The widely quoted report of a cheetah running at 71 m.p.h. (114 km h⁻¹) was discredited some time ago — not only was the distance over which the speed was measured found to be 65 not 80 yards as first thought, but the timing was inaccurate and the arithmetic faulty. Other calculations have been made from films, using the animal's body length to estimate the distances involved. These yielded a disappointingly low estimate of 56 m.p.h. (90 km h⁻¹),

suggesting that the cheetah might be outspurred by a Thomson's gazelle — though timings of the speed of the gazelle are themselves subject to doubt.

The speed for the cheetah now reported was assessed very simply. Sharp, then an athletics coach, who says he was "well used to hand timing", measured a course of 220 yd (201.2 m), marked at either end by posts and a thin tape. The cheetah was held 18 m from the posts, to allow a running start, and when its attention was caught by a meat lure held from the back of a Landrover, it was released. The cheetah chased the Landrover over the course, and was timed with two calibrated stopwatches.

Three separate runs yielded almost identical speeds — the fastest was a rather impressive 65 m.p.h. (105 km h⁻¹), still much faster than racehorses at 69 km h⁻¹, or greyhounds at 58 km h⁻¹.

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