Control of Spatiotemporal Coherence of a Thalamic Oscillation by...
termination time of spindle sequences were (Fig. 2, top) by plotting the LFP voltage changes among the thalamic sites. Because suction (n = 8) and replaced the electrodes in approximately the same position (Fig. 1). In the decorticated cat, the occurrence of spindle sequences in the different electrodes was largely not coincident in time (10); however, some spindle sequences were still nearly synchronous (Fig. 1, Decorticated).

To compare the spatiotemporal characteristics of spindle oscillations in the thalamus with a strongly coherent manner over the entire recorded thalamic area, as indicated by the formation of horizontal yellow (maximum local activity) and blue (local silence) stripes at 8 to 10 Hz on the vertical columns. Not only were spindle sequences initiated synchronously, but each oscillatory cycle formed uninterrupted yellow and blue stripes across the thalamic activity.

organized pattern (Fig. 2, Decorticated) with an absence of stripes, indicating that oscillatory activity was no longer synchronized among thalamic sites located more than 2 or 3 mm apart.

The coincidence in the appearance of spindle oscillations among the eight electrodes was analyzed by calculating the second-order correlation (Fig. 2) (11).
tion between their spindle-related intracellular activities.

A possible mechanism by which the cortex exerts its global effect on spatiotemporal organization of thalamic oscillations is the more divergent projection of corticothalamo-

Fig. 3. Synchronized spindle sequences of closely located TC cells in the decorticated thalamus. (A) Couples of TC cells (designated TC1 and TC2) were intracel-

lularly recorded at distances

.. precipitating the offset of the cyclic IPSPs; through excitation of RE cells and exci-

tation of the onset of the IPSPs of both.

We favor the role of the RE nucleus, taking into consideration the divergent projections of its rostral pole (14), that in turn receive convergent projections from various cortical areas (12).

An alternative explanation for the en-

synchronizing role of the cortex would be that spread zones scattered within cortical areas, because of the abundant horizontal corticocortical projections in areas 5 and 7A (10) and thereafter imposed on the thalamus. To investigate the role of intracortical excitatory circuits, we performed intracellular recordings in the same array of electrodes as for thalamic recordings. In

activity at right). The rightmost event expanded below the leftmost event and the middle event is the characteristic of spindle activity. Spindle-related IPSPs were assigned to the time of their onset at a fast time reference (dotted line). The intracellular recording from TC2 was aligned to the same reference, revealing the occurrence of IPSPs that were al-

most simultaneous with TC1. B: TC cells were recorded simultaneously from the VL nucleus (TC1) and the LP nucleus (TC2), distant by 4 mm. Spindles occurring spontaneously in TC2 lagged by 20 ms compared with TC1, 0.5 s after the termination of a spindle in TC1 (c.f. Fig. 2A, rightmost IPSP) (t = 10) from TC1 compared with a flat line at TCO

