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Rich club neurons dominate Information Transfer in local cortical networks SUNNY NIGAM, MASANORI SHIMONO[1], OLAF SPORNS, JOHN BEGGS, Indiana Univ - Bloomington — The performance of complex networks depends on how they route their traffic. It is unknown how information is transferred in local cortical networks of hundreds of closely-spaced neurons. To address this, it is necessary to record simultaneously from hundreds of neurons at a spacing that matches typical axonal connection distances, and at a temporal resolution that matches synaptic delays. We used a 512 electrode array (60 μm spacing) to record spontaneous activity at 20 kHz, simultaneously from up to 700 neurons in slice cultures of mouse somatosensory cortex for 1 hr at a time. We used transfer entropy to quantify directed information transfer (IT) between pairs of neurons. We found an approximately lognormal distribution of firing rates as reported in in-vivo. Pairwise information transfer strengths also were nearly lognormally distributed, similar to synaptic strengths. 20% of the neurons accounted for 70% of the total IT coming into, and going out of the network and were defined as rich nodes. These rich nodes were more densely and strongly connected to each other expected by chance, forming a rich club. This highly uneven distribution of IT has implications for the efficiency and robustness of local cortical networks, and gives clues to the plastic processes that shape them.

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