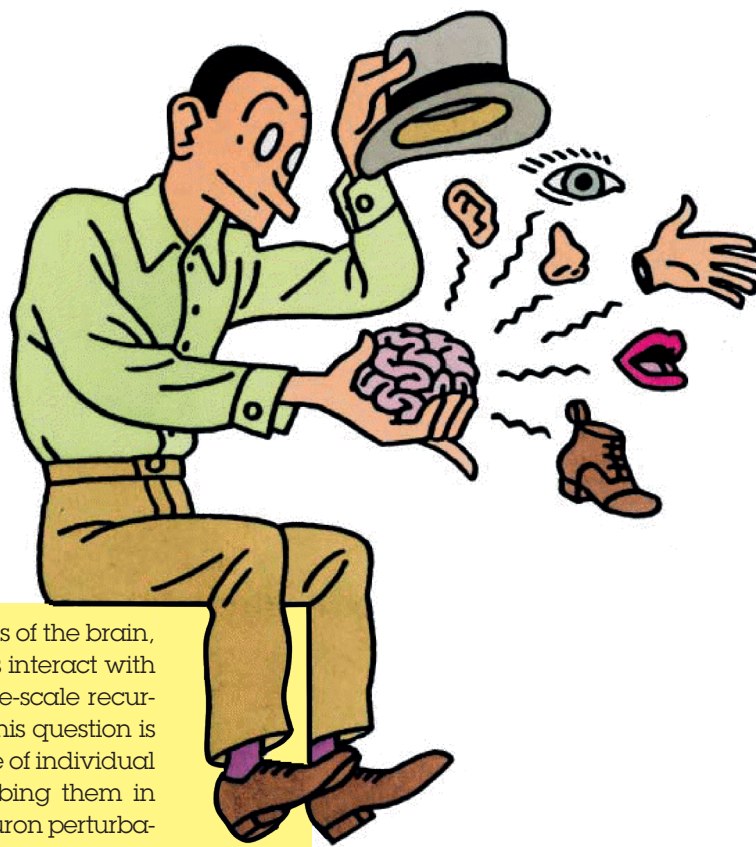**TWENTY-FIRST ANNUAL**

DEPARTMENT OF NEUROSCIENCE

SEMINAR SERIES

CLAUDIA CLOPATH
Bioengineering Dept. Imperial College London

SEPTEMBER, 4 2023

Theory of neural perturbome

To unravel the functional properties of the brain, we need to untangle how neurons interact with each other and coordinate in large-scale recurrent networks. A way to address this question is to measure the functional influence of individual neurons on each other by perturbing them in vivo. Application of such single-neuron perturbations in mouse visual cortex has recently revealed feature-specific suppression between excitatory neurons, despite the presence of highly specific excitatory connectivity, which was deemed to underlie feature-specific amplification. Here, we studied which connectivity profiles are consistent with these seemingly contradictory observations, by modeling the effect of single-neuron perturbations in large-scale neuronal networks. Our numerical simulations and mathematical analysis revealed that, contrary to the prima facie assumption, neither inhibition dominance nor broad inhibition alone were sufficient to explain the experimental findings; instead, strong and functionally specific excitatory–inhibitory connectivity was necessary, consistent with recent findings in the primary visual cortex of rodents. Such networks had a higher capacity to encode and decode natural images, and this was accompanied by the emergence of response gain nonlinearities at the population level. Our study provides a general computational framework to investigate how single-neuron perturbations are linked to cortical connectivity and sensory coding and paves the road to map the perturbome of neuronal networks in future studies.

Erasmus MC
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Time: 17.00 hrs
Online
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