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Core-periphery structure of brain cortical networks MELINDA VARGA, DANIEL BARABASI, ZOLTAN TOROCZKAI, University of Notre Dame — The first step towards understanding how the brain works is to describe its structure, its wiring and the guiding principles behind it. With the use of retrograde tracing experiments, which yield reliable directed and weighted connectivity data, the mouse and macaque monkey cortex was mapped at the level of functional areas. Although very dense, these interareal networks have strong structural specificity. We show that this is governed by an exponential cost to wiring, the probability of connecting two areas decreases exponentially with the distance between them. To define the importance of this rule, we constructed a single-parameter random graph model, which indeed predicted several weighted and binary properties of the networks. Using a non-traditional clique-based method we show the existence of a core-periphery structure in the experimental data, a key property of any functional network, which was found by the model as well. To emphasize the validity of this structure we used various binary and weighted importance measures (spectral and path based centralities, hierarchical decomposition, clique distribution analysis), which result in consistent outcomes. These findings underline the importance of the exponential cost to wiring, as a guiding principle in brain formation.

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