Modelling the inter-areal cortical network based on a distance rule

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Comparing interareal cortical networks across brains of different sizes and mammalian orders provides robust information on evolutionarily preserved features and species-specific processing modalities. However, these networks are spatially embedded, directed, and weighted, making comparisons challenging. Analysis of the large-scale connectome inferred from a consistent database of retrograde tracer experiments in the macaque cortex have shown that many of its local, global and weighted properties are well predicted by a simple network model based on an exponential distance rule (EDR): the number of axons decays exponentially with their length with rate λ, expressing wiring economy [1,2]. We have shown that the large-scale connectome of the mouse [3,4] and the rat [5] cortex is also strongly determined by an EDR network, but with a different decay rate λ. Comparisons reveal the existence of network invariants between the species, exemplified in graph motif profiles and connection similarity indices, but also significant differences, such as fractionally smaller and much weaker long-distance connections in the macaque than in mouse.

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