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Impact of Stability on Random and Small-World Brain Networks[1]
RICHARD GRAY, PETER ROBINSON, CANDY FUNG, School of Physics, University of Sydney — The dynamics and stability of networks of brain components are studied to determine the role stability plays in constraining the network structure of the brain. The linear stability of a brain network is determined from a physiologically based continuum model of the brain's electrical activity. If instabilities correspond to neurological disorders such as seizures, stability is an important constraint on network structure and, hence, brain physiology and anatomy. Results for random brain networks and small-world networks are presented, showing that stability sharply constrains random network structure to satisfy $npg < 1$, where n is the number of components, p the probability of connection, and g the connection gain. In contrast, small-world networks have a stability boundary independent of n with a connectivity similar to experimentally determined cortical networks. Implications of these results to brain structure and its evolution are made, along with comparisons with cortical connection networks.

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