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Linking network structure and stochastic dynamics to neural activity patterns involved in sleep-wake regulation

Sleep and wake states are each maintained by activity in a corresponding neuronal network, with mutually inhibitory connections between the networks. In infant mammals, the durations of both states are exponentially distributed, whereas in adults, the wake states yield a heavy-tailed distribution. What drives this transformation of the wake distribution? Is it the altered network structure or a change in neuronal dynamics? What properties of the network are necessary for maintenance of neural activity on the network and what mechanisms are involved in transitioning between sleep and wake states? We explore these issues using random graph theory, specifically looking at stochastic processes occurring on random graphs, and also by investigating the accuracy of predictions made by deterministic approximations of stochastic processes on networks.

References

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