Bursting neurons follow the same beat, sometimes

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A simplified mathematical model of the brain's neural circuitry shows that repetitious, overlapped firing of neurons can lead to the waves of overly synchronized brain activity that may cause the halting movements that are a hallmark of Parkinson's disease.

The model provides a tool in the quest to gain a better understanding of the mechanisms behind this incurable degenerative disorder.

Researchers from IUPUI (Indiana University-Purdue University Indianapolis) reduced the complex biology of the basal ganglia, a part of the brain involved in voluntary motor control, down to a key system of two interconnected cells. The cells were linked together in an inhibitory relationship, meaning a signal from one cell would suppress the second cell's firing. The team ran simulations of the two-cell system while tinkering with the parameters of the model. For example, since levels of the neurotransmitter dopamine decrease in Parkinson's patients, increasing the inhibitory coupling strength between cells, the team tested how the strength of the inhibitory connection affected the cells' synchronization.

In a paper in the AIP's journal *Chaos,* the researchers identified specific ranges of coupling strength most likely to lead to bursts of intermittently synchronized firings.

The team also produced squiggly-lined graphs showing how the complex interactions between slow-changing variables such as calcium ion

concentration can cause intermittent synchronization of the two cells. Although the model is based on a neural network known to be affected by Parkinson's disease, the authors believe that their mathematical model might also yield insights into the operation of more generic neural systems.

More information: "Intermittent synchronization in a network of bursting neurons" by Choongseok Park et al. is accepted for publication in *Chaos: An Interdisciplinary Journal of Nonlinear Science.*

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