Supercomputer Simulations may Pinpoint Causes of Parkinson's, Alzheimer's Diseases

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The work of researchers at UC San Diego and the San Diego Supercomputer Center is featured on the cover of the current issue of the Federation of European Biochemical Societies Journal

Using the massive computer-simulation power of the San Diego Supercomputer Center (SDSC) at UC San Diego, researchers are zeroing in on the causes of Parkinson's disease, Alzheimer's disease, rheumatoid arthritis and other diseases.

A study published in this week's Federation of European Biochemical Societies (FEBS) Journal offers – for the first time – a model for the

complex process of aggregation of a protein known as alpha-synuclein, which in turn leads to harmful ring-like or pore-like structures in human membranes, the kind of damage found in Parkinson's and Alzheimer's patients.

The researchers at SDSC and UC San Diego also found that the destructive properties of alpha-synuclein can be blocked by beta-synuclein – a finding that could lead to treatments for many debilitating diseases.

The current journal's cover features an image from the research that helps illustrate the scientists' work.

"This is one of the first studies to use supercomputers to model how alpha-synuclein complexes damage the cells, and how that could be blocked," said Eliezer Masliah, professor of neurosciences and pathology at UC San Diego. "We believe that these ring- or pore-like structures might be deleterious to the cells, and we have a unique opportunity to better understand how alpha-synuclein is involved in the pathogenesis of Parkinson's disease, and how to reverse this process."

Igor Tsigelny, project scientist in chemistry and biochemistry at UC San Diego and a researcher at SDSC, said that the team's research helped confirm what researchers had suspected. "The present study – using molecular modeling and molecular dynamics simulations in combination with biochemical and ultrastructural analysis – shows that alpha-synuclein can lead to the formation of pore-like structures on membranes."

In contrast, he said, "beta-synuclein appears to block the propagation of alpha-synucleins into harmful structures."

The complex calculations for the study were performed on Blue Gene

supercomputers at SDSC and the Argonne National Labs.

Tsigelny worked in collaboration with Pazit Bar-On, Department of Neurosciences; Yuriy Sharikov of SDSC; Leslie Crews of the Department of Pathology; Makoto Hashimoto of Neurosciences; Mark A. Miller of SDSC; Steve H. Keller in Medicine; Oleksandr Platoshyn and Jason X.J. Yuan, both in Medicine; and Masliah, all at UC San Diego.

Source: UC San Diego