α-synuclein, a benign protein involved in neurotransmitter regulation, is also associated with neurodegenerative diseases, including Parkinson's Disease (PD) and Lewy Body Dementia (LBD). PD affects 500,000 people every year, and is linked to the degeneration of motion control centers in the brain. LBD is a disorder that affects cognitive, autonomic, and sleeping habits in people over 65. α-synuclein helps regulate synaptic vesicle pools, dopamine, and the formation of soluble N-ethylmaleimide-sensitive factor (SNARE) complexes which help vesicles fuse with the membrane, as well as other less-studied functions. α-synuclein’s most understood function is the regulation of vesicle pools in neurons. When no α-synuclein is present, vesicles ‘dock’ with a membrane, fusing and releasing neurotransmitters which transmit signals in the brain. When α-synuclein accumulates, the vesicles are prevented from fusing and releasing neurotransmitters. Depending on the environment α-synuclein can take the shape of an α-helix, β-sheet, or be unstructured. For instance, α-synuclein is unstructured until it nears a membrane, where it takes on an α-helical conformation: an advantage in fusing with the membrane. The β-sheet conformation is found primarily in Lewy Bodies in PD and LBD patients. In order to understand α-synuclein’s role in PD and LBD, scientists must first learn more about its structure and function; research being carried out even today.

Researchers have found that excess α-synuclein blocks the vesicles from docking on the plasma membrane. Thus, no signal is passed between the neurons. Parkinson’s Disease •Group of conditions called motor system disorders. •Symptoms include trembling, stiffness, impaired balance and slowness of movement. •Chronic and progressive. •1 in 200 will get Parkinson’s Disease during their lifetime with the risk increasing with age. •Rate doubles for people over 60. •More common in men than women. •No specific cause known.

Lewy Body Dementia •Involves dementia and motor symptoms. •Similar to Alzheimer’s disease. •Dementia caused by damage in the brain. •Symptoms include hallucinations, memory-related problems, motor problems, trouble with speech. •Second most common form of dementia after Alzheimer’s. •20% of the 7 million cases of dementia in the United States. •33% of dementia illnesses in elderly Americans. •No specific cause known.

Neurons communicate with one another via chemical signals or neurotransmitters; an example of which is dopamine. Dopamine is a hormone associated with motor activity, sleep, mood, cognition and behavior. The process of neurotransmitter release is illustrated above. Vesicles containing neurotransmitters dock and fuse with the plasma membrane, releasing neurotransmitters. α-synuclein regulates this process by slowing the release of dopamine.

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