Canadian Association of Physicists
Association canadienne des physiciens et physiciennes

Contribution ID: **2751** Type: **Oral (Non-Student) / Orale (non-étudiant(e))**

Changes in lipid membrane may trigger amyloid toxicity in Alzheimer's disease.

Thursday 6 June 2019 10:45 (15 minutes)

Alzheimer's disease (AD) is a neurodegenerative disease characterized by dementia and memory loss for which no cure or prevention is available. Amyloid toxicity is a result of the non-specific interaction of toxic amyloid oligomers with the plasma membrane which induce damage and death of neuronal cells. Understanding these interactions is of high importance.

We studied interaction of amyloid beta (1-42) peptide with lipid membrane using atomic force microscopy (AFM), Kelvin probe force microscopy (KPFM), black lipid membrane (BLM) and surface Plasmon resonance (SPR). We demonstrated that composition, structure and properties of lipid membrane play an active role in amyloid binding and toxicity: changes in membrane composition mimicking AD increase amyloid binding and toxicity. Effect of lipid composition, the presence of cholesterol and melatonin are discussed. We demonstrated that membrane cholesterol creates nanoscale electrostatic domains which induce preferential binding of amyloid peptide, while membrane melatonin changes the properties of the membrane and protects the membrane from amyloid binding and damage. These findings contribute to better understanding of the molecular mechanisms of Alzheimer's disease and aid to the developments of novel strategies for cure and prevention of AD.

References:

1. E.Drolle, K.Hammond, A.Negoda, E.Pavlov, Z.Leonenko, Changes in lipid membranes may trigger amyloid toxicity in Alzheimer's disease. PLOS ONE, 2017, 12(8), e0182194.
2. B Mehrazma, M Robinson, SKA Opare, A Petoyan, J Lou, FT Hane, A Rauk, Z Leonenko, Biochimica et Biophysica Acta (BBA)-Proteins and Proteomics 1865 (11), 1707-1718.
3. E.Drolle, R.M.Gaikwad, Z.Leonenko, Nanoscale electrostatic domains in cholesterol-laden lipid membranes create a target for amyloid binding. Biophysical Journal, 2012, 103(4), L27-L29.
4. E.Drolle, F.Hane, B.Lee, Z.Leonenko, Atomic force microscopy to study molecular mechanisms of amyloid fibril formation and toxicity in Alzheimer's disease. J. of Drug Metabolism Reviews, 2014, 46(2): 207-223.
5. E.Drolle, N. Kučerka, M.I.Hoopes, Y.Choi, J. Katsaras, M. Karttunen, Z.Leonenko, Effect of melatonin and cholesterol on the structure of DOPC and DPPC membranes, Biochimica & Biophysica Acta: Biomembranes, 2013, 1828 (9): 2247-2254.
6. E. Drolle, A. Ollagnier, E. Finot, Z. Leonenko (2016). Surface Plasmon Resonance Imaging to Study the Molecular Mechanism of Alzheimer's Disease. Allsensors. ISBN: 978-1-61208-523-4

Author: Prof. LEONENKO, Zoya (University of Waterloo)

Co-authors: DROLLE, E. (University of Waterloo); ROBINSON, M. (University of Waterloo); TURNBULL, S. (University of Waterloo); MEI, N. (University of Waterloo); FILICE, C. (University of Waterloo); LEE, B. (University of Waterloo); PAVLOV, E. (University of Waterloo); FINOT, E. (University of Waterloo)

Presenter: Prof. LEONENKO, Zoya (University of Waterloo)

Session Classification: R1-2 Membrane Biophysics Joint Session Part I (DPMB/DCMMP/BSC) | Session conjointe sur la biophysique des membranes I (DPMB/DPMCM/SBC)

Track Classification: Physics in Medicine and Biology / Physique en médecine et en biologie (DPMB-DPMB)