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Developing Quantum Mechanics and Machine Learning based Approaches for Reliable Computing of Druglike Properties

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Developing drugs and diagnostic agents for various neurodegenerative diseases is a major challenge in healthcare sectors of developed and developing countries.[1] Moreover, a growing number of multidrug resistant microorganisms as well demand for the development of expeditious protocols for designing novel drugs.[2] The traditional trial and error based experimental screening is highly expensive and time taking [3] We will have to use rational computational approaches to make steady and swift progress in developing drugs and diagnostic agents. The binding affinity, binding specificity, pharmacokinetic and pharmacodynamic properties and target specific spectroscopic properties of the lead compounds are the few quantities which we need to optimize for their use in medicine for therapy and diagnosis. At the positive side, we live in a privileged time where we have access to huge chemical space (small molecule database), and protein database and genomics (targets database) and facilities to do petascale computing.[4,5] The major drawback is that we do not have methods to compute subsystem interaction energies (or binding free energies) reliably and to study the properties of ligands when they are bound to their targets or in solvent environment. In this presentation, I will discuss about the integrated computational approaches developed inhouse and are suitable for calculating the binding free energies reliably and modeling optical properties of molecules in the presence of target biomacromolecules [6,7]. Case studies involving binding affinity calculation for PET tracers and “optical tracking” of biomolecules like amyloid fibril, membrane, enzymes and DNA will be presented in some detail [8].

References:

[1] J. Cummings, et al., Alzheimer's Research & Therapy, 8, 39 (2016)
[2] H. W. Boucher, et al., Clin Infect Dis., 48(1),1-12.(2009)
[3] A. Mullard, Nature Reviews Drug Discovery volume 13, page 877 (2014)
[4] L. C. Blum, J.-L. Reymond, J. Am. Chem. Soc., 131(25),8732(2009)
[5] C.M. Dobson, Nature, 432, 824-828 (2004)
[6] K. Rajasekhar, et al., Biosensors and Bioelectronics, 8, 54(2017)
[7] N.A. Murugan, et al., Phys. Chem. Chem. Phys., 20, 20334(2018)
[8] N.A. Murugan*, et al., ACS Chem. Neurosci., 97,1757 (2018)