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Metformin - "une pierre deux coups": Metabolic modelling for Diabetes and Cancer treatment

Rajeev Khoodeeram[1], **Jean-Yves Trosset**[2] and **Gilles Bernot**[3]
[1]Université des Mascareignes, Mauritius
[2]SupBioTech, Paris, France
[3]UCA, France

Metformin is a double-edged therapeutic candidate for the treatment of metabolic diseases like diabetes and cancer. This is due to its antihyperglycemic and apoptic chemical properties making metformin an ideal drug proposed by WHO. It is widely known that the underlying mechanism of action of metformin is mainly governed by the energy-sensor AMPK which play key roles in regulating on one side the glucose intake in cells and on the other side controlling cell death. To better understand the metabolic role of metformin, we first built a mathematical model of energy metabolism in normal cell to simulate energy and biomass production. We then extended the model by incorporating metformin as a new variable to interact with the primary variables of central carbon metabolism including glycolysis, the TCA cycle and the oxidative phosphorylation phase. Due to the complex nature of carbon metabolism, we prefer a coarse-grained approach by minimising the intricate interactions of few hundred variables. We investigate the effect of this new variable in energy generation as well as biomass production both central to diabetes and cancer. The results observed supports the evidence of the influence of metformin (in combination with other precursors) in overall metabolic cycle and fine tuning the logical level of metformin allows us to mimic different cellular conditions. In this way, testing a combination of other drugs having the same potential as metformin could become straight forward solutions in the fight against diabetes and cancer, which are life-threatening diseases on the global scale. The proposed model could be used as a blueprint for plugging other biological models including the cell cycle and the circadian rhythm. This could enable the investigation of more complex scenarios like chronotherapy important for precision medecine.

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Biography

Rajeev Khoodeeram is a Senior lecturer at the Université des Mascareignes and occupies also the post of Head of department (Emerging Technologies) as well as Head of Campus. His first degree is in Computer science and later he did a Master degree in the field of electrical and electronic engineering, and landed with a PhD in Bioinformatics from Université Côte D'Azur, France. His expertise is in the field of modelling complex systems (environmental and biological). He also shows (and teaches as well) interest in the field of Artificial Intelligence (ML and DL) and Internet of things (environmental and biological). Prior to joining the academic world, he has gained some industrial experience and has continued to help some startups as a freelancer. Khoodeeram is currently piloting an MSc in Industrial Internet of Things for the manufacturing sector in Mauritius.

rkhoodeeram@udm.ac.mu