UNIVERSITÉ DU LUXEMBOURG

Physics meets Biology online colloquium

Wednesday, January 27th, 2021 at 4 pm

Talk by Dr. Philippe NGHE

Maître de Conférences ESPCI
Laboratoire de Biochimie
CNRS-ESPCI ParisTech

(*Invited by Prof. Massimiliano Esposito*)

Autocatalytic networks toward Darwinian evolution

Abstract:

How did evolution emerge in physical-chemical systems during the origin of life? Reproduction requires autocatalysis, but evolution further requires a diversity of autocatalytic systems. In a first study, we found universal stoichiometric criteria to recognize autocatalysis in reaction networks. This analysis unifies our view of self-reproduction in already known systems and indicates that there may exist many others. In a second study, we experimentally measured the dynamics of thousands of autocatalytic RNA reaction networks. The resulting landscape reveals trade-offs between the Darwinian properties of variation and selection in self-reproducing systems. Finally, I will discuss how Darwinian evolution may ultimately be implemented in RNA recombination networks.

Biography:

[1] Ameta, S., Arsène, S., Foulon, S., Saudemont, B., Clifton, B. E., Griffiths, A. D., & Nghe, P. (2021). Darwinian properties and their trade-offs in autocatalytic RNA reaction networks, Nature Communications (2021, in press)

[2] Blokhuis, A., Lacoste, D., & Nghe, P., Universal motifs and the diversity of autocatalytic systems. Proceedings of the National Academy of Sciences, 117(41), 25230-25236 (2020)

Philippe Nghe did a PhD in soft matter fluids (ESPCI Paris) and a post-doc in Biophysics (AMOLF, ND). He is now associate professor at ESPCI Paris where his group works on single cell analysis, experimental evolution, and origin of life. He combines technological developments and theory to establish tools to measure and model biochemical reaction networks, with a particular emphasis on the mechanistic understanding of evolution.