

Biological processes modelling based on elementary actions and synthetic biology

Revisiting biological functions

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Our laboratory (mix lab between CNRS and a private company Bio-rad) is devoted to interdisciplinary research on complex pathologies diagnosis. To open new ways in colo-rectal cancer early diagnosis, we develop a synthetic biology approach to design a synthetic bio-system (a vesicle with a synthetic biological network) able to perform programmed tasks in a biological environment. This approach is based on a ‘design _ modelling _ experimental’ validation cycle. The *in silico* design and modelling are taking advantage of biological processes modelling based on elementary actions. Early attempts to design computing approaches to model and/or simulate such a complex biological systems show the difficulty to answer real complex biological interrogation. One of the numerous reasons of these difficulties is the fuzziness of the concept of biological function. But understand biological functions and their relationships with biological structures is critical to understand biological systems; currently, we need a better definition, and if possible a formal description, in order to design powerful and meaningful modelling and simulation systems. Starting from what we know about chemistry and biochemistry of molecular actors of the biological systems we revisited the concept of biological function and we identified a limited set of Basic Elementary Actions (BEA). Combinations of such a BEAs can describe the diversity of known biological functions. Moreover, using a four level of detail scale we proposed a new biological function description scheme (Bio Ψ) very useful to formal manipulation of the biological function knowledge.