

Ex Post Analysis of the *Systems Biology* Programme (2012-2017)

The *Systems Biology* Programme was implemented by ITMO Cancer-Aviesan in the frame of the last two French Cancer Plans (2009-13 and 2014-19). It aimed at promoting data integration tools and prediction models development (both for clinical practice application and to acquire fundamental knowledge on oncogenesis) and at gathering disciplines involved in the data compilation, data mining and modelling. This document presents key learnings coming from the ex post analysis of the Programme realised in July 2018.

Key figures

- 146 submitted projects
- 26 projects funded
- Selection rate : 18%
- 25 PI
- 80 partners (median 3 per project)
- €14.28M (median €531k per project)
- PI age: median 43 y.o.

A Multidisciplinary Commitment to the Programme

Outcomes* (8 completed projects in 2018)

- 25 personnel hired (median 3 per project)
- 11 international collaborations
- 1 *Systems Biology* devoted research unit
- 15 tools, models or data sets
- 5 patents
- 42 publications, including 32 original articles (75% in open access)

*at the date of the analysis (July 2018)

PI research fields were diversified enough to get data integration and modelling all along the continuum from biology to clinics: 57% of the applicants had a biomedical profile (medicine or biology) and 43% a profile of physics, mathematics or bioinformatics. Almost one quarter of them did not have a large experience in oncology. Programming the call encouraged therefore a new population of scientists to strengthen the ranks of the systems biology research applied to cancer. This structuring impact of the Programme led furthermore to the creation of a research group devoted to *Systems Biology* and the building of 11 international collaborations. Projects

fields reflect dual aspects - clinical and fundamental - of the Programme. They were for a narrow majority in the CSO categories *Biology* (53%), then *Treatment* (21%), *Scientific models* (14%) and *Early detection, diagnosis and prognosis* (12%). Projects in *Biology* were mainly in the subcategories *Resources* (including mathematical models) and *Chromosomal aberrations* or *Oncogenes* (in relation with cancer initiation).

New Tools Already Valuated and New Knowledge Still to be Confirmed

Tools were mainly published in peer-reviewed journals ranked in the 1st quartile in their field (especially biology, biochemistry and mathematics, or multidisciplinary sciences). Furthermore, some of the tools (e.g., RNASeq analysis processes, mitotic events analysis software, proteomic data sets) were available in open access to the scientific community, and 5 patents were requested. On the other hand, the new fundamental knowledge (including markers, treatment targets or signalling pathways) was often not already published, highlighting how time to validate biological findings is incompressible.

Tools and Knowledge* (8 completed projects in 2018)

- Pipelines of analyses
- Mathematical models
- Mechanisms of cancer progression (pathways, driver mutations)
- Mechanisms of hormone or treatment resistance

at the date of the analysis (July 2018)

Projects funded were regarded by the evaluation committees as being of very good quality and presenting a great diversity, in accordance to the multidisciplinary approach of *Systems Biology*. These findings and the growing number of applicants between 2012 and 2017 indicate that France has a good reservoir of research teams in the field of *System Biology* applied to cancer.