SystemsX.ch

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Abstract: SystemsX.ch has the objective of supporting and promoting the paradigm shift in life sciences research, moving from qualitative to quantitative and predictive biology. The Swiss government has invested CHF 220 million in around 250 interdisciplinary projects involving more than 400 research groups since 2008. Almost half of the projects are designed for PhD students and postdocs to train the next generation of systems biologists. The initiative will conclude in 2018; different measures will ensure its sustainable impact.

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SystemsX.ch
The Swiss Initiative in Systems Biology

SystemsX.ch is the largest public research initiative in Switzerland so far. It was set in motion in 2007 when the Federal Government proposed in its 'Dispatch on Education, Research and Innovation 2008–2011' to promote systems biology research in Switzerland. SystemsX.ch will come to an end in 2018. Since 2008, CHF 220 million have been invested with the main aims of (i) supporting academic research projects applying the systems approach in life sciences, (ii) educating the next generation of systems biologists, (iii) supporting private–public sector partnerships, and (iv) participating in international systems biology programs. Overall, around 250 projects carried out by more than 400 research groups have been funded through the initiative. Each year, approximately 1000 scientists have been involved in SystemsX.ch projects. The projects are grouped into several categories:

- Research and Technology Development Projects (RTD): large interdisciplinary research projects carried out by consortia consisting of more than three different research groups (duration 4 years, SystemsX.ch funds: CHF 2 to 8 million)
- Medical Research and Development Projects (MRD): large interdisciplinary projects similar to RTDs, with explicit medical or clinical topics (3 years; CHF 1.3 to 2.4 million)
- SyBIT: one overall IT project to support and provide research IT services to the RTD and MRD Projects (SyBIT; 8 years, approx. CHF 2 million per year)
- Bridge-to-Industry Projects (BIP): promoting collaboration with industrial partners (1 year, CHF 120,000), and Transfer Projects (TF) (2 years, CHF 300,000)
- Transition Postdoc Fellowships (TPdF): fellowships for postdocs who transition into a new scientific discipline, complementary to the one in which they obtained their PhD (2 to 3 years, salary + CHF 30,000)
- Interdisciplinary PhD Projects (IPhD): fellowships for PhD students who carry out their research with two different supervisors, who work on different scientific disciplines (3 to 4 years, salary + CHF 40,000)
- Interdisciplinary Pilot Projects (IPP): promoting high-risk, not main-stream research (1 year, CHF 120,000)
- Smaller-scale projects to support the development of highly innovative research or technologies: High Tech Funds (HT; large range) and Special Opportunity Projects (1 to 2 years, CHF 200,000)
- International research projects within the ERA-Net consortium ERASysAPP (3 years, CHF 250,000 to 500,000)

One defining requirement of SystemsX.ch was that all federal funds granted had to be at least matched and contributed to the projects by the participating institutions. This means that almost CHF 500 million will have been invested in systems biology research in Switzerland by 2018.

SystemsX.ch is legally a simple partnership, which has grown from originally seven equal partner institutions to what are today fifteen, encompassing federal and cantonal universities, the public and private sector, and covering every corner of Switzerland: ETH Zurich, EPF Lausanne, the Universities of Basel, Bern, Fribourg, Geneva, Lausanne, Neuchâtel and Zurich, the Università della Svizzera Italiana, the Swiss Institute of Bioinformatics, the Friedrich Miescher Institute, the Paul Scherrer Institute, the Zurich University of Applied Sciences and IBM Zurich Research Lab.

An efficient collaboration with the Swiss National Science Foundation (SNSF) has been central to the success of the initiative. The SNSF has reviewed the work of SystemsX.ch as a whole, and it has evaluated the submitted project proposals with support from the SystemsX.ch Scientific Executive Board. The progress of the large consortia projects (RTDs and MRDs) is examined by the SNSF through mid-term reviews, which, in some cases, have led to projects readapting their milestones or receiving conditional approval for further funding. This has ensured that only very high quality projects are promoted.

SystemsX.ch has decisively influenced the way research in the Swiss life science community is carried out today. This has been achieved through proactively encouraging the establishment of interdisciplinary, inter-institutional research consortia. The initiative has brought together groups from disciplines that formerly had nothing or little to do with each other. The network of collaborations instigated through research funding has already proven to be solid, with SystemsX.ch-involved groups

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submitting joint grant proposals to other funding bodies, or organizing joint conferences. Furthermore, each IPhD Project has brought together two to three PhD supervisors from different fields, and sometimes even different institutions, with the aim of training doctoral students in a truly interdisciplinary manner.

The education of a new generation of scientists, capable of bridging several disciplines, is an important cornerstone of SystemsX.ch. By 2018, IPhD Projects will have enabled almost 90 young scientists to obtain their doctorates in this novel format. The TPdF Projects have also fostered interdisciplinarity by enabling more than 30 young postdocs to gain knowledge and experience in a new field of research that is different and complementary to the one they obtained their doctorate in. These scientists have acquired capabilities that are essential for current and future research in the life sciences. They approach research with a multidisciplinary vision, with an understanding of how biology must cross borders to achieve better results, to be a more powerful tool for answering complex questions. Moreover, their training should provide them with a competitive edge in the job market.

From the beginning, the SystemsX.ch Initiative was meant to be finite. Participating institutions committed themselves to promoting systems biology research by providing matching funds for SystemsX.ch projects. As for sustainability, the initiative has contributed to various

science IT support platforms at the partner institutions, most of which did not exist when SystemsX.ch started in 2008, and which will continue to run after 2018. Within the initiative, the bioinformatics project SyBIT (Systems Biology IT) has provided central services and support to cope with the flood of digital data generated in the projects. SyBIT works in close collaboration with the Swiss Institute of Bioinformatics ISB-SIB, with Vital-IT also supporting SystemsX.ch researchers.

Community-building has been a crucial part of this initiative, since it is the basis of networking and a valuable tool for overcoming barriers between different disciplines, as well as between institutions within Switzerland. The funding activities of SystemsX.ch, mainly the calls for RTD and MRD proposals, are a driving force to foster networking, initiate and support cooperation among different Swiss institutions and beyond. Moreover, an active community in the field of systems biology is an important factor for the sustainability of the initiative and also contributes to its international outreach. To strengthen the Swiss systems biology community, several measures have been taken: scientific events, including seven All SystemsX.ch Days and three International SystemsX.ch Conferences (Basel in 2011, Lausanne in 2014 and Zurich in 2017), as well as meetings with the principle investigators from RTDs and MRDs are organized up to twice a year. The yearly SystemsX.ch retreats, postdoc workshops, as well as

thematic conferences, courses and schools co-organized with other institutions in Switzerland and abroad, have not only cemented these community-building efforts, but also further supported the initiative's goal of educating the next-generation of systems biologists.

With the initiative approaching its end, several indicators attest to its success, going much further than the excellent publication record of the SystemsX.ch projects. As intended, the initiative has acted as a catalyst for Swiss systems biology and has generated many indirect benefits. Switzerland is widely recognized as one of the top countries in systems biology research worldwide. The interdisciplinary character of students and postdocs trained through the initiative is unmistakable. The partner institutions have started to deploy sustainability measures, and a strong systems biology community has been built in Switzerland. After 2018, when SystemsX.ch will officially come to an end, research funding for systems biology projects will no longer come from a specifically dedicated vehicle, but from the classical funding structures (SNSF, European projects, *etc.*). The foundations for a successful research network have been laid. Scientists involved in SystemsX.ch projects will continue to do research in interdisciplinary, inter-institutional consortia to understand, measure, model and predict biological processes.

This is 'new biology': instead of a wet lab course, PhD students and postdocs are trained in bioinformatics. Several summer schools (here on 'Systems modelling' in 2015) were jointly organized by SystemsX.ch and the Swiss Institute of Bioinformatics (SIB).
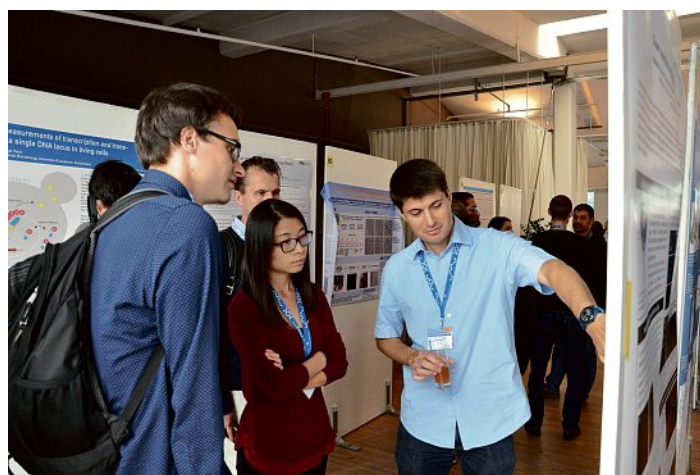
At the 'All SystemsX.ch Day' (here 2015 in Bern) more than 200 scientists convene to be informed about latest news and scientific results. The poster session with up to 90 posters offers young researchers to present and discuss their work with colleagues.