



Contract no.: LSSG-CT-2003-503218

EUSYSBIO

The Take-off of European Systems Biology

SPECIFIC SUPPORT ACTION

PRIORITY 1

Life Sciences, Genomics and Biotechnology for Health

<i>Final Activity Report</i>

Period covered from:
01. Nov. 2003 to 31. Oct. 2005

Date or preparation:
15. Jan. 2006

Start date of project:
01. Nov. 2003

Duration:
24 months

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Publishable Executive Summary

Thanks to the recent spectacular advances in the "-omics" disciplines and in information technology (IT), **the biosciences are heading for the *in silico* simulation of complex life processes**. This branch of research, termed systems biology (SB), combines concepts from molecular biology, engineering sciences, mathematics and IT in a holistic approach to complex biological systems, for example living cells. SB is currently being promoted intensively in ambitious funding initiatives in particular in the United States and Japan.

The goal of EUSYSBIO is the **assessment of activities in Systems Biology** is providing an active **contribution to establishing a European Research Area for Systems Biology (SB)**. To achieve this major goal of EUSYSBIO a series of workpackages were designed to identify and bundle existing strengths and competences, identify existing weaknesses and coordinate ongoing SB activities. Europe's innovative biotech industry, – mainly consisting of SMEs – has all the necessary know-how required to **use the opportunities offered by the commercialisation of SB results**. In addition Europe's SB experts were brought together. The SSA furthermore focused on the **training of young scientists, on the international networking of activities and relevant players and on contacts with science, industry and the general public**. EUSYSBIO formed the nucleus of further European activities and prepare start of a powerful pan-European research initiative in SB.

The results of the EUSYSBIO cover survey activities: International benchmarking of SB and foresight have been performed. A report on SB activities in the new member states as well as in Eastern countries of Europe, in Russia and in China is also available. A broad overview on programmes in EU member states had been gained.

Networking activities were initiated on industrial level during an **SME** workshop which brought together interested companies and scientists, on **policy maker** level two meetings were held allowing representatives of the national funding agencies to learn about their respective programmes and to discuss models of cooperation. On **scientific level** a standardization workshop was held in the framework of the ICSB. Standards which allow cooperation and data exchange across Europe were established.

Information activities were carried out: The **EUSYSBIO internet platform** was launched and updated with documents. A **database** was set up for scientists to register to facilitate exchange and communication. This database is aimed at scientists looking for cooperation and students searching places for doctoral and post-doctoral training. Specialized **training activities** were organised to educate doctoral students and post-docs. A **lecture course** took place in March 2005 in Gosau, Austria.

1. Project execution

WP1 International benchmarking and foresight of systems biology

WP 1 objectives:

- to develop a clear definition of systems biology which is accepted by the scientific community. Such a definition is expected to facilitate systems biology actors speaking a common language and identification with systems biology
- to elaborate an assessment of Europe's position in systems biology in the international context
- to identify future developments and strengths of systems biology including scientific and technological trends but also socio-economic issues.

The following results were achieved:

- A definition of systems biology was elaborated
- A benchmarking concept for systems biology activities was developed
- A foresight workshop on systems biology was organised where systems biology experts together with other experts from social sciences identified and discussed short and long-term perspectives of the field.

WP2 Survey on SB in NAS countries, Russia, and China and strategic implications for FP6 („Digging out buried treasures in the East“)

WP 2 objectives:

- Establishing a virtual working group on SB of representatives from PTJ, NAS-NCP and IB
- Specifying of a common strategy for systematic data collection.
- Inquiry in the target countries.
- Data collection and processing
- Dissemination

The following results were achieved:

- The working group was established with the International Bureau of The German Federal Ministry (IB) via a meeting in march 2004. Participants were representatives of the IB responsible for Russia and former members of the Russian Federation, China, the Baltic Countries and the new EU member states.
- The collected comprised relevant research institutes (public or private), names of key actors, national or regional research programmes, main topics, recent publications, specific equipment and infrastructures, human resources and training, planned activities, international cooperations, etc.
- The standard questionnaire was be distributed in the target countries via the NCPs and IB into leading research institutes and funding organisations.
- Replies and the data were analysed and combined to a comprehensive report which acts as the basis for outlining the final report.

- Report has been disseminated in various meetings and on the internet

WP3 Industrial Platform

WP 3 objective was to alert SMEs and to provide industrial enterprises with opportunities to tap into SB know how as early as possible.

The following results were achieved:

A satellite workshop was organised on Oct 11, 2004 titled *Industrial Perspectives of Systems Biology*. It took place on the eve of the International Conference on Systems Biology ICSB2004 in Heidelberg. EUSYSBIO's partners SYMBIONIC, VBU, Swiss Biotech Association, France Biotech, Dialog<->Gentechnik, Bioindustry Association, and EuropaBio co-operated in compiling a list of some 950 European companies and relevant persons which were invited to the event by two mailing rounds. The lecture series eventually attracted 146 participants from industry and academia, some representing the non-EU countries US, Switzerland, Singapore, Canada, and Israel. Seven presentations were cleared for dissemination to the partners and are accessible online through www.eusysbio.org (password: eusysbio; user: partner).

WP4 Organisation of an EUSYSBIO satellite workshop at the International Conference on Systems Biology, ICSB 2004 in Heidelberg

The EUSYSBIO satellite workshop was delayed in agreement with the European Commission services and was held on 12-13 September 2005 as the final meeting of EUSYSBIO. In the framework of the ICSB three EUSYSBIO workshops were organized. The visibility of the project was high.

WP5 Training and Human Resources

WP 5 objectives:

- Development of the structure and agenda of a lecture- and a laboratory course, establishment of teaching material, and recruitment of visitor speakers.
- Identification of European investigators actively involved in ongoing SB student training activities in Europe
- Standard computer scripts (PERL) for online registration for advanced SB lecture & practical courses
- Develop a training agenda

The following results were achieved:

- The first FEBS advanced lecture course in Gosau/Austria took place in March 12-18, 2005 involving the main European investigators in the field.
- The database was set up for scientists and students at www.sysbiolDB.org
- The script has been written and adapted for the SB lecture course. It is available and can be used.
- The training agenda was developed and reflected in the programme of the lecture course.

WP6 Policy Maker Forum

WP 6 objectives:

- Identification of Stakeholders
- Policy Maker Workshop
- Dissemination in the final report and in the course of an EUSYSBIO-workshop:

The following results were achieved:

- Institutions already involved in SB activities were identified. Sources had been the representative of the Programme Committee for Priority 1, the National Contact Points for Priority 1 and contacts available from the Cogene Forum.
- Two policy maker workshops were held: Berlin, 1., 2. April 20 2004 and Paris, 26., 27. Aug. 2004
- The ERA-NET ERASysBio went to contract negotiations with the Commission and that the first transnational programme SysMO has been started and the first joint call has been opened.

WP7 PR and information platform

WP 7 objectives were to seek awareness of SB in different scientific communities policy makers and media.

The following results were achieved:

- The EUSYSBIO intranet and internet website went online in March 2004 at www.eusysbio.org. The website offers general information on SB and EUSYSBIO, 'public' documents, a calendar, and relevant weblinks. A restricted access area (username: partner and password: eusysbio) provides the partners and EC administrators with documents and data files which were not cleared or had been embargoed by the authors for public dissemination.
- ISB informed a large audience on the SSA through articles in a German/Swiss biotech journal and newsletter services, e-mailings to the members of scientific organisations and public lectures on various occasions (BioPerspectives 2004, Statusseminar Biochips 2004, ICSB 2004).
- WP7 produced brief press releases on EUSYSBIO and the Gosau Workshop of WP2 which were submitted to some biotech magazines and IDW, a news service for science journalists. They were fully reproduced in 'transkript'. The journal has high impact on the SME community in Germany, Austria, and Switzerland.
- The announcements for the EUSYSBIO's *Industrial Perspectives of Systems Biology* and for the FEBS workshop on *Systems Biology: From Molecules & Modelling to Cells* (March 12-18, 2005 at Gosau, Austria) were submitted to journals and posted in relevant online conference calendars.

WP8 Establishing a scientific platform on SB: ESBIGH

WP 8 objectives: To propose for the first time to bridge the many small national research programmes of Europe and then to help co-ordinate a coherent European effort in SB.

The following results were achieved:

- Extensive files have been constructed concerning persons, institutes and companies, listing all available information about the people and groups that are active in the field of Systems Biology in Europe. A web-based database has been constructed with this information, allowing all interested parties to search for potential connections or collaborations on a European scale.
- The ESBIGH (a proposed NoE related to EUSYSBIO) activity was subsumed in BioSim, which became a European Network of Excellence, and in which Westerhoff became member of the board. The ESBIGH-EUSYSBIO related activities aimed at mapping systems biology connections to pharmacology and drug design was carried out by Westerhoff through this route (cf. <http://chaos.fys.dtu.dk/biosim/>)
- Collaboration was sought with the Organization of National Science Funding Organizations in Europe (ESF). This led to the formation of a committee which then studied the perspectives for Systems Biology in Europe.
- The work package leaders (Eils, Kuchler, and Westerhoff) assumed many functions at various strategic spots in Systems Biology in Europe. Here they emphasized networking in Europe between countries, standardization and data sharing. One example is that all three were on the board of the HepatoSys programs international steering committee (the large German Systems Biology program). Westerhoff was also on the ISB panel, which selected three centres of UK Systems Biology for substantial funding by the BBSRC and EPSRC. Again he emphasized the importance of European collaboration and standards.
- An impressive result of this work package is one to which of course also others factors contributed: the transnational funding program SYSMO. The work package leader attended the German BMBF when it was planning to organize a German SB funding programs for systems biology of microorganisms, to the fact that other national funding organizations might be considering similar national programs and that it would make more sense to organize such a program across European borders. Thanks to an enthusiastic response initially of the BMBF, and then of the NL and UK organizations, the first deadline for proposals was early January 2006 and also included Austria, Norway and Spain. This activity served as an example for and is subsumed in the newly funded ERANET (FP6-EU) activity.
- The organization of European Systems Biology, but now in the context of world-wide systems biology was also promoted through the co-organization of three world-wide Systems Biology leagues, i.e. IEcA (E. coli systems Biology), YSBN (Yeast Systems Biology Network) and RTKC (Receptor Tyrosine Kinase Consortium). These became important vehicles for interactions of European systems biologists.
- A well-attended Workshop on Standards was held on October 10, 2004 during the 5th International Conference on Systems Biology in Heidelberg. An audience of approximately 140 scientists discussed 11 presentations and delivered comments that were simultaneously recorded on screen for all to accept or amend. The results of these deliberations have been put into a report. This report shows the pressing need for better validation of assays and models, agreement on the parameters to be measured and on the modelling software to be used. In conjunction with the European Sciences Foundation another workshop was held in the spring of 2005, in Gosau, AU. This workshop was much less formal but continued to reinforce the need for live standards for Systems Biology among a group of 200 active systems biologists. The standardization process can be further followed on the EUSYSBIO-WP8 website www.eusysbio.net .

- After these general discussions it became clear that it was time to engage in standardization, in actual fields of systems biology. This was effected through the three systems biology leagues IEcA, RTKC and YSBN where particularly the latter has become active because it received EU funding.
- As a first activity for a journal, a website was opened: www.eusysbio.net. An inventory was made of the needs for a journal for Systems Biology and of current activities in this respect. Two activities are relevant here. In November 2004 the IEEE started publishing a printed journal called 'Systems Biology'. The first issue bears the date 'June 2004'. Although these initiatives may seem to diminish greatly the need for another Systems Biology journal, we nevertheless identified the persons responsible for the biological sciences (including Systems Biology) at the world's largest publisher Elsevier BV, also publisher of the Cell series. We discussed Elsevier's potential role, the formation of an editorial board, recruitment of referees and how to organize electronic publishing via a website of a full-text searchable journal. As this appointment was materializing, EMBO Journal in collaboration with Nature also started a new Systems Biology journal. In addition other existing journals, such as FEBS Journal greatly enhanced the visibility of their Systems Biology sections. This made Elsevier wary of such an initiative; their Molecular Cell was thought to cover the topic, and indeed, important Systems Biology papers have now been published in this journal.
- With this, the traditional bias in many journals against cell biology papers including modelling had disappeared and similarly the bias of theoretical journals against the inclusion of experimental results had faded. This work package then decided that creating a new journal apart from the major existing journals could well work counter productively by taking away systems biology results from the higher visibility in the existing journals. Therefore, this part of the work package then focused on two other sub initiatives described here under 4.2 and 4.3.
- 19 papers were solicited and co-edited to become a book, which has meanwhile been published (Systems Biology; Definitions and Perspectives, 2005, Springer, eds.: Alberghina & Westerhoff). The authors of the chapters included most of the best known European Systems Biologists, who had been asked to define the field by describing examples.
- An entirely new way of publishing systems biology, which had been already initiated by Snoep & Westerhoff) was brought to adulthood: it is now supported by three important scientific journals. High quality models in systems biology papers are here published on a website that enables in silico experimentation, cf. www.siliconcell.net and ff).

2. Final plan for using and disseminating knowledge

Section 1 - Exploitable knowledge and its Use

No exploitable results.

Section 2 – Dissemination of knowledge

Overview table

Planned/ actual Dates	Type	Type of audience	Countries addressed	Partner responsible/ involved
Finished	EUSYSBIO internet platform	general public	all	3
Finished	EUSYSBIO intranet platform	consortium	member states of consortium	3
Finished	database of SB experts	research and industry	all	3/8
Finished	SME-Workshop	research and industry	all	3/SYMBIONIC
Finished	Standardization workshop	research and industry	all	8
Finished	Survey on activities in the East	research and industry	all	1
Finished	Foresight workshop	experts	Europe, USA	2
Finished	Lecture course on SB	doctoral and post- doctoral students	all	5
Finished	Benchmarking and foresight study	research and industry	all	2
Finished	EUSYSBIO workshop	consortium and invited speakers	all	4
Finished	Final report	general interested public	Europe	1

Communication and exchange of knowledge and expertise is a crucial aim of the project. Thus, a whole workpackage is designated to enable a close communication between the partners of the consortium and the public (*WP7: PR and information platform*). In addition a database containing names and addresses of experts has been implemented to allow searching for collaborative partners. In addition it is a tool for human mobility, for example for students looking for post-doc positions.

Fast presentation and exchange of knowledge to the public and within the consortium will be facilitated by an internet- and an intranet-platform. Any relevant results obtained in the project will be presented here as well as calendars of events.

A series of workshops will be organised as part of the workpackages to allow exchange of personal expertise and knowledge within the different fora. They will be designed to bring together stakeholders already active in SB on industrial, organisational or political level and those planning or being interested in starting SB activities. Thus a personal network will be established as a basis for further joint European activities.

Section 3 - Publishable results

As the major achievement in the dissemination of this project results, 19 papers were solicited and co-edited to become a book, which was published (Systems Biology; Definitions and Perspectives, 2005, Springer, eds.: Alberghina & Westerhoff).

Book "The Take-off of European Systems Biology (EUSYSBIO) – Benchmarking and Foresight of Systems Biology in Central and Eastern European countries and China" was published, attached to the this report.