

Towards a European Strategy for Synthetic Biology

8 December 2008



Documentation of the TESSY Implementation Workshop

Évry, 18 November 2008

Challenges in Funding Synthetic Biology (TESSY Deliverable D4.2)

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1 Introduction

The TESSY Implementation Workshop was organised as a platform for knowledge exchange on Synthetic Biology (SB). It aimed at providing an insight into funding needs and funding options. The participants were encouraged to discuss challenges and hurdles in Synthetic Biology funding and analyse approaches for the development of a Synthetic Biology (funding) strategy. Additionally, it was the event to launch the SB Self Assessment Tool, which provides a set of indicators to illustrate the fields that have an impact on Synthetic Biology and/or are impacted by Synthetic Biology.

Table 1: Agenda of the Meeting

Time	Topic	Speaker
9:00 – 9:30	Arrival and Coffee	
9:30 – 9:45	Welcome Address	Françoise Russo-Marie (Head of Genopole Research; France)
9:45 -10:05	Introduction into Synthetic Biology (SB) and the Workshop Goals	Sibylle Gaisser (Fraunhofer ISI; Germany)
10:05 – 10:25	Synthetic Biology funding – the current situation	Astrid Lunkes (ESF, France)
10:25 – 10:45	Coffee Break	
10:45 – 11:15	Synthetic Biology Funding – what is needed from a strategic and educative perspective	François Képès (Génopole; France)
11:15 – 11:45	The UK situation – SB strategy development at the BBSRC	Amanda Collis (BBSRC, UK)
11:45 – 12:15	An overview of Strategy in the UK for SB - implications for Europe and the field internationally	Richard Kitney (Imperial College London, UK)
12:15 – 12:30	Introduction of the self assessment tool	Sibylle Gaisser (Fraunhofer ISI, Germany)
12:30 – 14:15	Lunch Break	
14:15 – 15:15	Working groups: Challenges and barriers in the development of SB strategies	
15:15 – 15:30	Coffee Break	
15:30 – 16:15	Presentation of working group results and plenum discussion	
16.15 – 16.45	International activities in Synthetic Biology: an insight into the OECD approach	Marie-Ange Baucher (OECD, Biotechnology Division, France)
16.45 – 17.00	Conclusions and next steps	Sibylle Gaisser (Fraunhofer ISI, Germany)



2 Participants

16 participants from 9 countries with background in science, funding, and politics participated in the implementation workshop. Contact addresses of all participants are listed in the annex.

3 Presentations to provide Background Information

The complete presentations can be downloaded from <http://www.tessy-europe.eu/news.html>

3.1 Insight into Genopole®

As host of the TESSY implementation workshop Françoise Russo-Marie who has been recently appointed as director of the Genopole® research department, opened the workshop with a welcome address and introduction into Genopole®, the leading biopark in France. Genopole® is dedicated to biotechnology and research in genetics, genomics and postgenomics. Its mission is (1) to foster research in genetics, genomics and post genomics, (2) create attractive conditions to hire internationally recognized leaders in the scientific areas developed on the campus and (3) stand at the cutting edge to promote new research programs. In 2007 797 employees worked in academic laboratories, 923 in biotechnology companies associated with Genopole®. The focus of the 22 research labs is with 59 % of all employees in the field of genomics, post-genomics and biotherapeutics. Nearly 20 % work in the field of biophysics/biochemistry and bioinformatics/biomathematics respectively and 4 % in the field of sciences for engineers. The Genopole enterprises have their focus in biomedicine/health (56 %), instrumentation (13.6 %), bioinformatics (9 %), bioproduction (4.5 %), agro-industries (3 %) and environment and chemistry (each 1.5 %). 10 % can not be categorized in the above categories. Currently, Genopole establishes a strong position in Systems and Synthetic Biology by the creation of an Institute of Systems and Synthetic Biology. This institute will open in July 2009 and will cover 1350 m² with dry and wet laboratories in close neighbourhood.

Download of the presentation: http://www.tessy-europe.eu/public_docs/Introduction_Russo-Marie-18November2008.pdf

3.2 Synthetic Biology Funding – the current situation

Astrid Lunkes, a Science Programme Manager at the European Sciences Foundation (ESF) and member of the TESSY consortium, gave an overview on the current funding options and requirements. A survey carried out in 2007 among 25 prominent European



scientists in the field of SB showed that most researchers prefer funding geared towards Europe or funding without geographical restrictions and with a strong interdisciplinary character. The EC Framework Programme 6 funded 18 projects with a total of €24.7 Mio and a focus on collaborative funding that contributed to the formation of a SB community in Europe. A number of European countries (UK, Germany, Spain, France, The Netherlands, Switzerland) experienced in the meantime the development of a core national SB community with some (limited funding) possibilities of individual investigators through responsive-mode schemes in a national context. Additionally, the Innovation group ITI Life Sciences, a part of ITI Scotland, launched a call in 2008 with a total budget of \$4-10 Mio for projects with focus on establishing novel technologies in order to develop commercial products in the field of gene and genome synthesis and assembly.

As the FP 6 seed funding in SB runs out in 2008/2009 and the few FP 7 funding options link SB to biotech applications it seems important to continue both with national and transnational funding. National funding could focus on strengthening the SB community on a national level whereas transnational funding could keep the momentum on EU level by joining national forces. Transnational funding options are

- 1) Bi-lateral collaboration: e.g. joint Call for Systems Biology by ANR & BBSRC in 2007
- 2) ERA-Nets: multi-lateral, depending on already existing national funding/priorities (top-down), e.g. ERA-SysBio. There was recently a second call.
- 3) EUROCORES: multi-lateral, bottom-up, launch of call is subject to sufficient financial commitment from funders, mainly ESF member organisations. A process dedicated to SB is ongoing as SB community submitted the theme which is currently out for funders for consideration to join. This call will be launched if sufficient commitment from funders is received by mid-December.

Download of the presentation: http://www.tessy-europe.eu/public_docs/SB-Funding_Lunkes-18November2008.pdf

3.3 Synthetic Biology Funding – what is needed from a strategic and educative perspective

François Képès, a Research Director at CNRS, the French National Center for Scientific Research and founding co-director of the Epigenomics Project, explained in his presentation that current research and development activities often lack involvement of industry. Future strategic SB development should aim at establishing a close contact between the public and private sector. However, this trend must be accompanied by a careful monitoring of Intellectual Property Rights to avoid the situation that the private



sector transforms academic inventions into new devices and academia will finally have to pay for this. Another essential prerequisite for future success in SB is to foster and establish transnational cooperation. This could be achieved by co-supervision of PhDs and Post-Docs across borders and small focused meetings which are decided bottom-up that help to start or maintain collaborations or prepare joined proposals. François Képès outlined that currently very few people are able to teach SB. An attempt is now being made at Genopole® to set up a master programme in Systems and Synthetic Biology. One part in the education of students could also be the participation at the IGEM competition of the Massachusetts Institute of Technology (MIT)¹ (Internationally Genetically Engineered Machines competition) which is both a motivating tool and a showcase to attract good students. François Képès pointed also on the absence of a textbook on Synthetic Biology, the need to prepare and share materials both for undergraduate and post-graduate teaching and a required network of SB teachers. Post-graduated teaching (e.g. PhD, post docs) in SB could be achieved by shared supervision between disciplines in one institution or across institutions.

Download of the presentation: http://www.tessy-europe.eu/public_docs/SB-Strategy-and-education_Kepes-18November2008.pdf

3.4 The UK situation- SB strategy development at the BBSRC

Amanda Collis, the head of Tools and Resources, Biomolecular Sciences and Engineering and Biological Systems at the UK's Biotechnology and Biological Sciences Research Council (BBSRC), illustrated the challenges in developing a SB funding strategy such as the multi-disciplinarity, the varying definitions, relatively low number of activities with strong activities in related fields, the need for integration of ELS issues and a wide range of applications. Prompted by the European NEST report the BBSRC carried out a strategic process for SB funding. The idea was to put in place an umbrella to cover different SB activities in this multi-disciplinary field. A first workshop that brought together the different communities showed the need for sustainable networks in SB. In consequences the BBSRC launched a call for dedicated SB networks among UK scientists that integrated also experts from other European countries. Additionally, all networks addressed ELS issues. As a parallel activity the BBSRC commissioned a study to address ethical and social issues of Synthetic Biology to Paul Martin, University of Nottingham (download of the report http://www.bbsrc.ac.uk/organisation/policies/reviews/scientific_areas/0806_synthetic_biology.pdf). In a third bundles of activities the BBSRC dealt with the internal research focus and the mode of project admini-

¹ For details please see http://2008.igem.org/Main_Page



stration and evaluation. After launching SB as one of the BBSRC's research priorities a new committee structure is being discussed that reduces the number of committees and thus allows a better coverage of interdisciplinary research.

3.5 An overview of Strategy in the UK for SB – implications for Europe and the field internationally

Richard Kitney, professor of BioMedical Systems Engineering and Chairman of the Institute of Systems and Synthetic Biology at Imperial College, London commented in his presentation on the UK strategy and highlighted future needs in SB. Richard Kitney showed that SB is the confluence of the two fields "Modern Biology" and "Engineering and Physical Sciences". Activities such as the MIT registry of Standard Biological Parts (<http://parts2.mit.edu>) are a logical consequence of the current development. However, in order to be sustainable they have to be established on a professional level. Richard Kitney reported the strong activities in the US with leading universities such as MIT, Harvard, UC Berkeley, Princeton, and Stanford being involved in SB research and strong private activities such as the \$500 million BP investment at UC Berkeley and the Craig Venter Institute with over 400 employees. In the UK he observed an ongoing dialogue between the research councils and the universities which culminated in the recommendation to establish three to five new major Systems and Synthetic Biology Centres. This required an investment of approximately £325 million over a period of 10 years. Each centre would have between 30 and 35 scientists and support staff plus 30 doctoral students.

The need for interdisciplinarity should encourage universities to break down barriers between disciplines and consider new methods of organisation. An example of such a centre with new structures is the Imperial College Institute of Systems and Synthetic Biology (IoSSB) which integrates three faculties (natural sciences, engineering, medicine) and the business school. Richard Kitney explained that the involvement of the business school is thought to be helpful in clarifying patenting issues and stimulating technology transfer. This aspect is closely linked to the role of small and medium sized enterprises (SMEs). Richard Kitney described SB as a new industrial revolution in the making with a shift comparable in importance to the ICT revolution and the power to revolutionise many sectors of the economy including parts/devices/systems, biofuels, biomaterials, biomedicines/drugs/vaccines, and biosensors. Thus, it seems important to stimulate the growth in Synthetic Biology and establish close relationships between academic researchers and industry.

Download of the presentation:

http://www.tessy-europe.eu/public_docs/UK-Perspective_Kitney-18November2008.pdf



4 Challenges and Hurdles in SB Funding

4.1 The SB Self Assessment Tool (SynBioAssess)

Sibylle Gaisser, the coordinator of the TESSY consortium and project manager at the Fraunhofer Institute Systems and Innovation Research in the Competence Center Emerging Technologies, demonstrated the SB self assessment tool (SynBioAssess). SynBioAssess is a set of indicators that illustrate the fields which have an impact on Synthetic Biology and/or are impacted by Synthetic Biology. The tool helps to collect all necessary data in SB and/or identify additional data requirements. It establishes a rational basis for decision-making on future funding and thus increases transparency in decision-making. The SynBioAssess allows to contrast the separately evaluated dimensions internal strengths/strengths of resources with the external strengths/ attractiveness of technology in a portfolio approach. An excel spreadsheet facilitates the answering. In this spreadsheet criteria for the internal strengths are clustered according to their contribution to (1) internal organization structure, (2) budget and instruments, (3) internal strategic focus, (4) timing, and (5) internal funding programme with potential link to Synthetic Biology. Criteria for technology attractiveness are clustered by (1) framework conditions, (2) number of research organisations in country XXX with interest in SB related topics, (3) other funding organisations, (4) SB related trends in country XXX absolute and in comparison to leading competitors, (5) maturity of SB research and development, and (6) expected impact on economy. In SynBioAssess each criterion can be answered in a "facts and numbers" column, followed by a proposal for quantitative assessment. The (weighted) values are summarized in one overall factor for internal and external strength which is displayed in a chart. For values above a certain threshold a strong investment into SB is recommended, below this threshold a careful consideration of the factors that lead to the observed result is recommended.

Sibylle Gaisser illustrated a number of sources of information that can be helpful in the utilisation of SynBioAssess. Whereas the identification of the internal criteria is within the competencies of the funding agency and has to be fed by internal analysis, external strengths analysis can benefit of the following sources:

- 1) Database on synthetic biology: <http://www.synthetic-biology.info/>. This database allows search by bibliography, concepts, authors, and institutions
- 2) Biopolis: "Inventory and analysis of national public policies that stimulate biotechnology research,...": http://ec.europa.eu/research/biosociety/library/brochures_reports-biopolis_en.htm. In this analysis data on public biotechnology R&D funding and policy performance in 32 European countries was gathered.



3) Bio4EU: Following a request of the European Parliament an assessment of modern biotechnology (red, green, white applications) was carried out. Results are available in by means of a main report, case studies on applications and data tables. Task 2 summarizes these reports: <http://bio4eu.jrc.ec.europa.eu/documents.html>

4) Europe INNOVA: The network driving European innovation has two fields of properties that are helpful in the assessment of SB:

- a) Innovation Watch: Sector report on biotechnology
- b) Innovation Panels: 5 rounds with reports that also cover biotechnology

Data from this process can be retrieved from <http://www.europe-innova.org/index.jsp>.

The Self Assessment Tool SynBioAssess and the presentation can be downloaded from the TESSY homepage: Download of the presentation: http://www.tessy-europe.eu/public_docs/SB-Assessment-Tool_Gaisser-18November2008.pdf. The Assessment Tool can be downloaded from <http://www.tessy-europe.eu/documents.html>.

4.2 International activities in Synthetic Biology: an insight into the OECD approach

Marie-Ange Baucher, a consultant in the biotechnology division of the OECD explained the ongoing OECD activities in the field of biotechnology and synthetic biology. The OECD biotechnology division realizes the input of the Working Party on Biotechnology, a group which brings together representatives from each member countries. This group discusses and informs about country priorities regarding the policy issues linked to Synthetic Biology development and decides which work goes forward in the division. The OECD aims at bringing in an international perspective in the ongoing SB activities and guiding a collective policy discussion amongst the OECD member countries. Based on the TESSY roadmap the OECD has identified the main policy issues and defined the issues on which the OECD sees its main expertise and could work. These are:

- The impact on research and products development of Intellectual Property Rights in Synthetic Biology (analytical report, case studies, policy recommendations...)
- Business models and strategies for Synthetic Biology development (analytical report, case studies, policy recommendations...)
- Biosecurity governance (best practice guidelines)
- Infrastructures needs (policy recommendations on education policies, research funding, etc.)
- The standardisation of parts and devices (framework, guidelines)



These considerations will culminate in a Symposium on the policy and political landscape around Synthetic Biology, which is jointly organised by the OECD with the US NAS and the UK Royal Society. It will take place the 20-21 April 2009 in Washington DC and will aim at discussing the policy interests in Synthetic Biology and the need for policy actions.

Download of the presentation:

http://www.tessy-europe.eu/public_docs/OECD_Baucher-18November2008.pdf

4.3 Plenum Discussion

In the final discussion the workshop participants concentrated on the following questions

- What are the challenges in SB funding in Europe?
- What are the hurdles in SB funding in Europe
- How can the challenges be overcome?

It was discussed that due to discontinuation of a strong EU support current SB funding relies mainly on a national basis. Some countries are confronted with the situation that they have a huge number of different pots (up to 25 in one country) that could be involved in SB funding which leads to the need of a more centralized administration of money for SB blue sky funding. On the other hand SB has a strong European dimension which led to the question why SB funding was not continued in FP7 on a similar scale as in FP6. It was argued that a continuous support of an emerging field is important and that the strategy of the European Commission to build up and catalyze a certain development without a sustainable and mid-term strategy would neglect this European dimension of SB, i.e. the funding of SB on a national level would not adequately allow to address the European/international character of SB. Another challenge in SB funding is the perception of the public. One participant outlined that "synthetic" has a negative connotation and that funding experiences also the challenge to address and convince the public in a certain field.

Thus, the participants concluded that the two major hurdles in SB funding are the lack of established systems for communication of scientific results including for example success stories (as they are established in the US) and the problem for national funding agencies to give money to other countries and thus establish international funding options. This would require the implementation of the system of a "pool of national funds". Eurocores and Era-Nets can be regarded as testing ground in that respect as they look into various funding schemes to support collaborative European research.



The process has been a challenging one so far since most funders act according to the principle of "juste de retour". The European Young Investigator Awards (EURYI) was an example of a successful pooling model, in which national money was virtually pooled and distributed to the best candidates irrespectively of their nationality.

The participants concluded that SB funding challenges have to be addressed by a number of measures. It was suggested to invest 5- 10 % of funds into SB communication. Possibilities for bi- or multilateral funding should be determined in more detail. i.e. by addressing political and administrative problems, stimulating Eurocores and EraNet-activities and checking good practice examples such as a Swiss-German agreement in which one agency has the lead but each country pays its own part in the joint activities. Finally, there was the strong request not to start to reduplicate European activities among national funding agencies but to build on the TESSY results of a high degree of required interaction between disciplines and countries with complementary skills: the need for future European activities on EU level should be communicated to the EC in order to set up further SB activities for example in a large integrated project on Synthetic Biology.



5 Annex

5.1 Participants

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5.2 Abbreviations

Abbreviation	Full Form
BBSRC	Biotechnology and Biological Sciences Research Council
CNRS	French National Center for Scientific Research
ELSI	Ethical, legal, social issues
ESF	European Science Foundation
ICT	Information and communication technologies
IP	Intellectual Property
IoSSB	Institute of Systems and Synthetic Biology
ISI	Fraunhofer Institute for Systems and Innovation Research
NEST	New and emerging science and technologies
OECD	Organisation of economic cooperation and development
SB	Synthetic Biology
SME	Small and medium sized enterprises
SynBioAssess	Self Assessment Tool on Synthetic Biology
TESSY	Towards a European Strategy for Synthetic Biology