EUROCORES Programme
European Collaborative Research

Synthetic Biology: Engineering Complex Biological Systems (EuroSYNBIO)

Consensus statement EuroSYNBIO Review Panel
(Final evaluation)

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In total, 4 out of 9 Review Panel members evaluated the EuroSYNBIO Programme. This consensus statement was formerly approved by 7 of the 9 Review Panel members.

Progress in the Collaborative Research Projects (CRPs)

- **progress towards CRP goals**

Interdisciplinarity, collaboration, European added value and novel scientific contributions were achieved at various levels by the five CRPs, each having strengths in some areas. In general, progress towards these goals was good to excellent, even if it is obvious that the duration of the projects was not long enough to achieve all what was initially proposed in those ambitious projects starting "from scratch".

- **integration and collaboration within the multinational CRP teams**

Multinationality (up to 5 countries within a project), workload distribution and collaboration generally demonstrated the usefulness of the CRP projects. The CRPs combined knowledge and skills of different research groups leading to very tight joint interactions and collaborations. However, the level of integration and collaboration within the multinational teams was rather diverse. Some teams showed a very good collaboration between PIs by several joint publications, common grants, interchange of students and workshops/seminars. Some brand new collaborations were formed and all project reports mention some formal continuation of the present CRPs. Most CRPs have started new integration with consortia being formed for future grant applications.

- **scientific highlights of the CRPs, including main achievements, contribution to knowledge, joint outputs**

The scientific highlights of the CRPs are many and fundamental for building up synthetic biology in Europe. One important achievement has been new information on how biological systems are working, providing breakthroughs enabling the achievements of the final goals. Development and improvement of techniques/tools, engineered biological modules, etc. have been achieved. Joint

publications in high level journals (*Science*, *PNAS*) and patents give proof for the achievements. Implementing a non-lab group investigating the ethical and societal issues also turned into a highly successful undertaking.
Scientific output varied from modest (e.g., Synmod, SynDiv) to excellent (e.g., SYNAPTA). SYNAPTA provided excellent publications and very good scientific breakthroughs which is a major success, although no collaborative papers can be reported. SynMet led to 5 joint publications of average IF and NANOCELL showed a good level of collaboration with at least 5 joint publications and excellent outcomes. Other CRPs demonstrated a rather weak collaboration at this stage (SynDiv: only 1 joint publication; SYNMOD like SYNAPTA: good publications but no joint publication). However, more publications can be expected in the following years derived from the work already carried out.
Some of the highlights in terms of publications are:

1. Männik, et al., Robustness and accuracy of cell division in Escherichia coli in diverse cell shapes. *Proc Natl Acad Sci USA* (2012)
2. Pogoryelov et al., Engineering rotor ring stoichiometries in the ATP synthase. *Proc Natl Acad Sci USA* (2012)
3. Pinheiro et al., Synthetic genetic polymers capable of heredity and evolution. *Science* (2012)

Programme integration

- **contribution of the CRPs to the programme and integration of the CRPs within the programme**

Overall, the five CRPs were well integrated into the programme and served well the build-up of the European synthetic biology community. The chosen CRPs complemented each other well:

- 3 involved more bottom-up research. SynDiv, Nanocell and SYNAPTA clearly contributed to the increase of basic science that in turn have constructed useful tools for synthetic biology. Given their relationship, their degree of interaction seems to be higher than with the rest of the Programme.
- 2 were focusing more on the biosynthetic potential of synthetic biology. Synmod and Synmet had a more industrial/process character, perhaps closer to the general aims of other European programmes; consequently, their scientific contributions were obvious.
- SynMod included ethical, legal and societal impacts and turned out to be most successful and of high interest for all the other CRPs.

The complementary expertise and infrastructure taken together substantially increased the visibility of synthetic biology in Europe and opened up for new networks and project collaborations within the CRPs.

- **added value of the programme for the CRPs (have the CRPs benefitted from being part of the programme?)**

According to the reports, joint meetings were useful and stimulating and new inter-CRP contacts were formed. All CRPs have clearly benefitted from being part of the programme in many ways: funding from the programme, but also additional funding nationally and internationally not only during EuroSYNBIO but also in the future (e.g. involvement of some of the EuroSYNBIO researchers in the ERA-Net ERASynBio: http://www.erasynbio.eu); intense and productive programme meetings; new openings via new collaborations; excellent research results; and becoming the most competitive group of synthetic biology in Europe as well as getting global impact.

Networking, training and dissemination

- **intensity of networking, training and dissemination activities and the level of participation of the various CRPs**

In general, networking, training and dissemination were done intensely by almost all CRPs.
The most important occasions of trans-project exchange and fertilisation have clearly appeared during the annual initiative-wide EuroSYNBIO meetings, i.e. during the conferences in Cannes (2011), Groningen (2012) and Schloss Elmau (2013). There, interactions between CRPs were greatly favoured since all PIs could meet and had sufficient time to exchange scientific information and initiate new projects (e.g. NANOCELL, SYNAPTA and SynDiv). Very importantly, SynMod had also focused explicitly on the societal context of the project which led to intense and constructive discussions during the joint meetings. It made a particularly relevant effort in making the Programme visible to the public

(e.g. Bio:Fiction Festival and the synthetic exhibition) which can be considered one of the highlights of the Programme and beneficial to the full area of synthetic biology.
The CRPs showed very good to excellent disseminations of results in different formats, from research papers in high-level journals (*Science*, *PNAS* or *Angewandte Chemie International Edition*) and patents to public presentations.
In order to close the EuroSYNBIO Programme, a special issue about synthetic biology will be published in the journal *ChemBioChem.* A TV film of 30 minutes about all involved CRPs has also been planned.

- **usefulness and impact of the networking, training and dissemination activities on the field of research and the programme goals**

All the different CRPs felt very strongly accepted by each other. The constant exchange with the other CRPs significantly widened the views on various approaches and techniques among the participants. New research directions emerged, laboratory techniques were shared, and new funding was applied for in some cases. Indeed, several groups have recently been successful in obtaining FP7 EU funding for synthetic biology research and several intend to apply from the ERA-Net ERASynBio which is now open for submission. These funding possibilities show that synthetic biology has been notified on the European scene. Altogether, the 5 CRP joint activities have had an immense impact on the research topics and produced a solid scientific and technological basis for synthetic biology in Europe.

Potential follow-up activities and future perspectives

Synthetic biology has been taken up in Europe, e.g. in Finland by the Academy of Finland recently granting «FinSynBio» projects also including bilateral projects with Indian partners (with 9 Million Euros) and of course the opened ERA-Net ERASynBio which promotes international collaborations.

General comments and other feedback

- **how well has the programme achieved its potential?**

The programme opened a unique opportunity in the synthetic biology field. As a result of the ESF programme, new contacts were formed within and between CRPs. As an indicator of success, all projects reported some kind of continuation of the current programme, based on new grants won or on applications for the ERA-Net ERASynBio funding. Scientific output was satisfactory with some top-level achievements (e.g., Synapta).
However, some projects had for several reasons not yet reached their full potential in terms of (joint) publications. Therefore, the general level of achievements in the CRPs might be considered a little inferior to what could be expected, a situation that is fully justified by the short duration of the Programme, the always difficult start of new collaborations and the complexity of some of the more ambitious projects.
Given the constraints, it can be considered that the Programme has provided seed money for nurturing the field of synthetic biology in Europe which entirely fulfils one of its main initial goals.

- **any other comments in relation to the facilitation and promotion of collaborative research?**

The programme strenghtened research fields where European excellence can be demonstrated. The EuroSYNBIO CRPs had an optimal size to be effective and to produce added value, thus being more effective than very big consortia. However, as synthetic biology is becoming more firmly defined and its foci better established, a wider programme with more funding needs to be put in place in order to represent all the various and growing fields of synthetic biology in Europe.
As the SynMet report stated: „It would have been fantastic with a follow-up EuroSYNBIO programme, allowing possibilities for new synthetic biology projects under the European Science Foundation. The organisation and administration by ESF on the program has been outstanding, with maximized focus on science and not on heavy administration…. the EuroSYNBIO was pioneering in bringing European synthetic biology research together, strengthening it, and in making visibility on this exciting research field."
The Programme will be concluded with two common actions in the format of review articles in *ChemBioChem* and of a movie about synthetic biology, thus fulfilling its initial goals of collaboration and visibility.