Genetic Resources Repository for Plant Metabolic Engineering and Synthetic Biology

Trans-WG Meeting May 08 – 09, 2014

VTT, Helsinki, FI

Background

The construction of genetic elements and their subsequent assembly into transcriptional units or genetic pathways and circuits for (plant) metabolic engineering and synthetic biology requires the amplification and/or *de novo* synthesis of large amounts of DNA. Although the assembly of higher-order genetic setups will become faster and easier with the widespread use of the emerging combinatorial and modular cloning systems (*MoClo*, *GoldenBraid*, *Gibbson assembly*, etc.), the first step for every laboratory will be the generation and sequence verification of kilobases of DNA to provide these basic modules. Especially since many genetic elements are redundantly used in numerous labs, it would be enormously advantageous to establish a central (either single- or multi-center) repository providing genetic building blocks for plant metabolic engineering and synthetic biology attempts. As a community effort, and on a non-profit basis, such a repository could speed up the development of new tools and products. Ultimately, such an effort should result in functional characterization of each genetic element deposited in the repository using standard descriptors.

Aim of the meeting

A repository of genetic elements that would be of use for the community needs to meet several requirements: i) it has to be open to everybody regarding depositing new sequences and the retrieval of stored ones; ii) all entries should be quality-checked and verified, and computational resources should be provided; iii) use of this resource should be inexpensive (e.g., handling charges only); iv) IP issues need to be appropriately addressed. Moreover, academic rewards to researchers/research groups depositing newly characterized genetic devices could be considered.

A clear demand for such a structure has been identified during recent COST Action FA1006 meetings. Here, we will evaluate how already existing repositories are being managed (*BioFab*, *BioBricks foundation*, *Adgene*, etc.) and how appropriate funding for the initiation of such an effort could be achieved, with special consideration of the new infrastructure programs under the *Horizon 2020* initiative (http://ec.europa.eu/research/participants/portal/desktop/en/opportunities/h2020/topics/64-infraia-1-2014-2015.html).

Given the fact that many infrastructure programs are of a considerably more substantial size than that anticipated for the *PlantEngine* “toolkit”, it might be necessary to cooperate with other, bigger, efforts and establish a subsection within a larger project. Invitation of experts in the issues of interest will help establish such contacts.

Meeting guidelines

Integrating activities for the EU plant synthetic biology community

1. Introduction

Plant Synthetic Biology (PSB) is accelerating its development in the EU. Its wide applications range from energy to food and pharma domains, and beyond. Funding opportunities are now emerging, mostly in the UK as well as at the EU level. Important clues for SB development in general, and PSB in particular, are (i) characterization, (ii) standardization, and (iii) exchange. It is, therefore, pivotal to initialize networking activities to facilitate and orchestrate PSB development in the EU following those principles. This meeting has been organized to try to identify networking requirements and opportunities, and discuss the possibilities for their efficient implementation.

2. Meeting objectives

I. To identify/propose networking/research activities/objectives that could help to potentiate PSB in Europe, discussing and comparing similar initiatives, also outside the plant research community.

II. To identify current EU/national/regional initiatives, laboratories, resources, and **infrastructures** that could foster/contribute to the PSB network community.

III. To identify funding instruments for such activities.

3. Basis and ideas for discussion

3.1. Regarding objective I

- The first possible activity is the creation of one or more repositories of parts and modules, including well-characterized multigene structures, plasmids, chassis, etc. This will require some infrastructure and material sharing, probably involving input of a non-profit organization. This objective imposes efforts in **standardization**. Current assembly standards, such as *MoClo*, *Golden Braid (GB2.0)*, and others, could be incorporated. **Automation** should also be considered as an important factor.
- Most importantly, any repository establishing initiative should be supported by a strong effort in part **characterization** involving **standard** rules**.** Close links with current genomic databases and genomic resources (*TAIR*, *SOLgenomics*, etc) will be required. Further, coordinated research activities to provide experimental data, e.g., organism-wide characterization of promoter activity, will be needed.

- Bioinformatics and systems biology should play pivotal roles in both integrating/creating models at the organism level as well as concerning small genetic networks. Thus, integration of databases will be a vital bioinformatics requirement.
- Interactivity and exchange should be potentiated, preferably relying on an open source basis**.** Characterization of biological parts could include rating systems mirroring users' experience. Rewarding systems could be put in place to endorse individual inputs (e.g., new entries of well-characterized parts could be acknowledged and listed as scientific contributions in early-stage researchers' CVs).
- Discussion should include complementation and/or overlap with current initiatives, such as *BioBricks*, *BioFab*, *Addgene*, other EU-level repositories, etc.

3.2. Regarding objective II

- Suggestions: *JIC*, *GARnet*, COST-*PlantEngine*, *VTT*, *MoClo* and *GB2.0*, *Addgene*.
- Stakeholders?

3.3. Regarding objective III

Discussion on the scope and possibilities of participation in the EU call *H2020-INFRAIA-2014-2015* (Integrating and Opening Research Infrastructures of European Interest), as a starting community (call title: Integrating and opening "**existing**" national research infrastructures). Analysis of additional current and/or future perspectives at the EU level and lobbing possibilities.

Activities to be developed within the *INFRAIA* call are:

- Networking activities to foster a culture of cooperation between research infrastructures, scientific communities, industries, and other stakeholders, as appropriate, and to help develop a more efficient and attractive European Research Area.
- Trans-national or virtual access activities to support scientific communities in their access to the identified research infrastructures.
- Joint research activities to improve, in quality and/or quantity, the integrated services provided at the European level by the specified infrastructures.

Program

Thursday, May 8

14:00	Presentation of the host institute, *VTT* *Heiko Rischer, FI*
14:15	Introduction to the COST Action FA1006, *PlantEngine* *Heribert Warzecha, DE*
14:30	Modular assembly systems: technologies and visions *Diego Orzaez, ES*
15:15	Modular assembly systems: technologies and visions *Sylvestre Marillonnet, DE*
	Presentations of current repositories
16:00	*EU-Openscreen* (http://www.eu-openscreen.eu/) *Ronald Frank, DE*
16:30	Coffee break
17:00	*Addgene* (https://www.addgene.org/) *Joanne Kamens, US* (video conference)
17:30	*MIRRI* (http://www.mirri.org/home.html) *Erko Stackebrandt, DE*
18:00	*iGEM and BioBricks Foundation* (http://parts.igem.org/Main_Page) *Randy Rettberg, US* (video conference)
20:00	Dinner

Friday, May 9

Presentations of scientific communities & potential users/contributors

9:15	*GARNet* (http://www.garnetcommunity.org.uk/) *Charis Cook, UK*
9:30	*OpenPlant* (www.openplant.org/) *Nicola Patron, UK*
10:00	*YeastCell* (www.yeastcell.eu/) *John Morrissey, IE*
10:30	Coffee break
11:00	Open discussion, identification of shortcomings and needs, recommendations
12:30	Lunch
14:00	Follow-up discussions *selected participants*

Participants

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Proceedings

Thursday, May 8

The meeting was opened by the MC Chair, *Heribert Warzecha, DE*, who extended his welcome to the participants representing diverse domains.

The welcoming address was followed by a short introduction to the mission and activities of the *VTT Technical Research Centre of Finland* (http://www.vtt.fi/), highlighting its unique interface status between basic and applied research, presented by the local organizer and host, *Heiko Richer, FI.*

Specific goals of the COST Action FA1006 were then discussed by *Heribert Warzecha, DE*:

- cross-linking a multidisciplinary network of European scientists with diverse expertise regarding plant natural products (PNPs),
- generating a map of the *status quo* and promising future research efforts for PNP metabolic engineering,
- defining target research strategies,
- investigating alternative steps to circumvent bottlenecks in PNP formation,
- investigating system approaches to advance PNP metabolic engineering,
- connecting academic and institutional research with industry, breeders, and policy-makers.

After concisely recounting the achievements of the Action and the individual efforts of *PlantEngine* Working Groups (featuring especially training schools, workshops, and STSMs), as well as the launch of the *Golden Braid 2.0* web-platform (https://gbcloning.org/), he focused on the future challenge of transforming the *PlantEngine* network into a legitimate *Plant Synthetic Biology Infrastructure* meeting the requirements of *Horizon 2020*.

Diego Orzaez, ES addressed the ongoing transition from biotechnology into the realm of synthetic biology, necessitating the development of more efficient DNA synthesis and assembly methods to tackle the challenges of plant metabolic engineering. He emphasized the importance of part **characterization** and **standardization** for the coordinated and vibrant exchange within the scientific community, dubbing them the pillars of the ultimate *PlantEngine* goal: the establishment of a centralized and open source inspired repository of genetic elements for PSB.
He went on to introduce *Golden Braid 2.0* (Sarrion-Perdigones A, Falconi EE, Zandalinas SI, Juárez P, Fernández-del-Carmen A, Granell A, Orzaez D. *PLoS ONE* 2011, 6:e21622; Sarrion-Perdigones A, Vazquez-Vilar M, Palací J, Castelijns B, Forment J, Ziarsolo P, Blanca J, Granell A, Orzaez D. *Plant Physiol* 2013, 162:1618-1631) as an example of a standardized, modular DNA assembly system for plant biology, highlighting the development of the GB grammar based software and the ever-

expanding database (https://gbcloning.org/). While a "starter kit" of basic GB parts has been made available, its distribution proved to reach beyond the capacity of the host lab/research group, further necessitating the launch of the postulated infrastructure.

Questions from the audience:

Q: Is there a need/rationale for restricting the proposed repository to plant genes/metabolites?

A: Of course not. The "plant community" is merely a founder of the initiative and its starting point.

Q: What is the handling fee for the "starter kit" delivery and does it pay to distribute it?

A: The minimal fee is difficult to estimate/calculate. The distribution is rather troublesome than beneficial.

Q: Has any company offered to buy the system?

A: No. Probably due to unclear patent situation.

The founder of the Golden Gate cloning technology (Engler C, Kandzia R, Marillonnet R. *PLoS ONE* 2008, 3:e3647; Engler C, Gruetzner R, Kandzia R, Marillonnet S. *PLoS ONE* 2009, 4:e5553), *Sylvestre Marillonnet, DE* reiterated the importance of **standardization** for the efficient assembly of DNA parts, constituting the corner stone of synthetic biology. He then introduced the Golden Gate based modular cloning system, *MoClo* (Weber E, Engler C, Gruetzner R, Werner S, Marillonnet S. *PLoS ONE* 2011, 6:e16765), enabling one-step assembly of multiple genetic elements, and the "*MoClo* tool kit" of two 96-well plates encompassing basic vectors and parts recently made available at *Addgene*. In light of the still persisting lack of *MoClo* online tools and software, the speaker emphasized the compatibility of the system with *Golden Braid 2.0* and the intended coordination of future efforts.

Questions from the audience:

Q: Does the "*MoClo* repository" include multigene structures?

A: The "tool kit" includes only the basic single parts.

Q: What about the already assembled metabolic pathways?

A: The future repository should not be limited. While the multigenes would not be distributed within the "starter/tool kit", they should be available from the centralized repository.

Suggestion (*Erko Stackebrandt, DE*):

It is important to store **all** DNA parts, as they might become relevant in the future.

Presentations of current repositories

Ronald Frank, DE introduced *EU-Openscreen* (http://www.eu-openscreen.eu/), the European Research Infrastructure of Open Screening Platforms for Chemical Biology coordinated at the Leibniz Institute of Molecular Pharmacology (FMP). After specifying its main objectives, he expounded upon the hub-and-nod structure of *EU-Openscreen*, integrating Europe's expert resources and facilities, and its unique prospective assets: *ECBL*, the European Chemical Biology Library encompassing 200k - 300k of fully annotated and quality controlled compounds, and *ECBD*, the European Chemical Biology Database, a web portal with powerful search and analysis capabilities hosted at EMBL-EBI. In conclusion, the speaker enumerated potential areas of common interest and synergies with *PlantEngine*, including:

- access of *EU-Openscreen* users to novel plant-born chemical diversity, including natural products as well as biosynthetically derived compounds,
- sustained and sufficient supply of complex plant-derived compounds,
- access of plant scientists to large-scale HTS for bio-activity and broad bio-profiling capabilities, as well as chemistry services for production of specific ligands (labeled, tagged, etc),
- exchange and co-development of software tools for the integration of plant genomics and metabolomics with molecular screening data into systems-wide modeling and analysis,
- mutual access to new user communities,

and more.

Questions from the audience:

Q: Are the screening services restricted to pure compounds?

A: Yes. *EU-Openscreen* does not offer extract analyses.

Q: Is it possible to order and obtain compounds from *EU-Openscreen*?

A: No. *EU-Openscreen* offers access to compound data. To obtain the actual compound, one would have to contact the original source lab/institution - the donor of the compound of interest to *ECBL*.

Q: How does *EU-Openscreen* propose to provide reliable metabolomic data for compound mixtures?

A: Through data extrapolation.

Q: What exactly is the planned support structure of *ECBL*?

A: ECBL is to constitute a large centralized library, distributed to diverse centers (experts) throughout Europe, each equipped with the full set of compounds.

Addgene (https://www.addgene.org/) was introduced as a non-profit, mission driven company dedicated to facilitating collaboration and sharing in the scientific community by its executive director, *Joanne Kamens, US*. In the opening remarks of her talk, she shared with the audience the challenges and opportunities in sustaining collections, as defined by the Ecological Society of America, Living Stocks Collection Workshop 2012 (http://www.esajournals.org/doi/pdf/10.1890/0012-9623-94.1.118). She then elaborated on the ever-expanding *Addgene* plasmid collection, defined the role of the company as that of a broker, helping scientists share plasmids (while the original constructs remain the exclusive possession of their creators), and emphasized the significance of the company's pioneering electronic MTA system enabling easy transfer of biomaterials between research institutions. A concise explanation of the deposit (free of charge) and request processes was followed by an exposé documenting *Addgene*'s impact, highlighting especially the depositors' increased citation rates. Finally, the speaker drew the participants' attention to the future launch of a synthetic biology site within the *Addgene* web resource suite, and proposed establishing a special PSB page in cooperation with *PlantEngine*.

Questions from the audience:

Q: While scientists are willing to deposit and share plasmids, they are still reluctant to do it with strains; why?

A: The reason is probably the much more complex quality control procedure required for strains. *Addgene* would like to distribute strains as well; however, the appropriate infrastructure is missing at the moment.

Q: Is there a function enabling tracking the plasmid-->publication route?

A: The *Addgene* team are working on it, but don't have the resources to follow all the literature (not all authors provide their publishing records directly).

Q: Is *Addgene* planning on cross-linking their resources with any DNA assembly softwares?

A: Many companies working on synthetic biology software contacted *Addgene*. Unfortunately, the *Addgene* library DNA sequence data-set is incomplete. The company is trying to improve on that.

Erko Stackebrandt, DE introduced the participants to *MIRRI*, the Microbial Resource Research Infrastructure (http://www.mirri.org/home.html) aiming at the coordinated integration of individual European culture collections, thus reducing unnecessary redundancies and taking the interoperability and accessibility of resources and data to a higher, yet unparalleled level. Governed by a Central Coordinating Unit, the national nodes and clusters of expert groups will constitute centers of excellence providing users with access to state-of-the-art technologies, data intercompatibility, and expertise for education and research in academia and the bio-industry, with a specific objective to

boost the bioeconomy. The speaker concluded by presenting a prospective intricate network of coordinated interdependencies and interactions within the MIRRI initiative.

Questions from the audience:

Q: Is it easier to ascertain appropriate funds for a central collection than obtain national funding?

A: Within *MIRRI*, the participating countries (nodes) are obliged to contribute funds. The existing individual funding systems will be maintained on the national level, but the long-term pan-European funding perspective will be managed centrally.

Q: How are plant cells usually stored/maintained within the existing collections?

A: No general protocol is in place. Mostly, the plant cells are maintained in the form of calli and transferred every second week.

Q: Is depositing new strains free of charge?

A: Unless there are patent issues to consider, yes.

In the final talk of the day, *Randy Rettberg, US*, the founder and coordinator of the *iGEM* competition, addressed the objectives of the *BioBricks Foundation* and the features of the *Registry of Standard Biological Parts* (http://parts.igem.org/Main_Page). Differentiating between two most common types of repositories, the database format on the one hand and the catalogue format (enabling user feedback) on the other, he argued the superiority of the *Registry of Standard Biological Parts* as the only existing repository integrating the two formats in a coordinated fashion. In conclusion, the speaker postulated that the future would bring the launch of numerous new repositories accompanied by the development of diverse software tools enabling coordinated 'communication' between all registries.

Questions from the audience:

Q: How is the *Registry* curated? Is sequencing the only control standard applied to the newly submitted parts?

A: Yes. All parts are sequenced twice: upon arrival and before re-distribution (for the following *iGEM* competition). Additionally, the submitted parts of potential interest are naturally 'seeded' (well-documented parts gain priority, while others are discontinued).

Q: Is the quality of the submitted part documentation reliable? It is, after all, compiled by students.

A: The re-usage of parts leads to data accumulation and verification. It is a 'work in progress' and the improvement might be gradual, but it can certainly be accomplished.

Friday, May 9

Presentations of scientific communities & potential users/contributors

Charis Cook, UK, the *GARNet* Liaison Officer, opened the second day of the meeting proceedings by introducing the BBSRC (Biotechnology and Biological Sciences Research Council) initiative as one aiming to inform, liaise, and support the UK *Arabidopsis* Research Community, to promote interactions with other UK plant science communities, and to enhance participation in international research (http://www.garnetcommunity.org.uk/). She then expounded upon *GARNet*'s involvement in promoting systems biology in the UK, providing examples of the BBSRC network activities, highlighting especially *GARNet* workshops and meetings and the resulting reports and/or papers. After drawing the participants' attention to the *GARNet* web resources (including a blog and a newsletter), she reiterated the ultimate goal of the BBSRC initiative: providing added value to research. The speaker concluded her talk by enumerating the recommendations formulated during the recent *GARNet* workshop on plant synthetic biology:

- enabling community sharing of biological parts,
- establishing an open source software repository,
- inspiring a generation of plant synthetic biologists,
- enabling training, partnerships, and collaborations,
- stakeholder mapping and public engagement,
- exploring licensing options,
- incentivizing development of new tools and approaches,

closely mirroring the objectives of *PlantEngine*.

Questions from the audience:

Q: What are *GARNet*'s expectations concerning their public engagement?

A: No definitive benefits are expected. The main goal of the initiative is to inform the public.

Q: Do *GARNet* team members find it hard to convince the public not to view the GM plants in a negative light?

A: The speaker does not specialize in this aspect of the public outreach; there are *GARNet* specialists in the field who could give a clear answer to the question.

Q: Have any repositories of genetic parts been already established in the UK?

A: There are several research groups aiming at launching such a repository, but no definitive action has been undertaken.

Suggestion (*Heribert Warzecha, DE*):

Perhaps the *Centre for Research Communications* of the University of Nottingham (http://crc.nottingham.ac.uk/) would have the capacity to host such a repository.

Nicola Patron, UK introduced the audience to the *OpenPlant* initiative: the Synthetic Biology Research Centre aiming to promote interdisciplinary exchange, open technologies for innovation, and responsible innovation for sustainable agriculture and conservation (www.openplant.org/). While enumerating the foundational technologies of *OpenPlant*, encompassing all aspects of synthetic biology, she put special emphasis on the issue of DNA assembly & open registries, pointing out its main objectives:

- to establish open-source registries in the UK for sharing information, and join the web of registries with plant-chassis specific parts,
- to explore new models for distributing plant DNAs and promoting quality control,
- to explore multi-tier strategies encompassing diverse assembly standards/methods (*MoClo*, *Golden Braid*, *USER*, *Gibson*).

In conclusion, the speaker drew the participants' attention to a simple, non-technical guide to installation of a DNA registry (JBEI-ICE): Inventory for Composable Elements (ICE) developed by the Joint Bio Energy Institute as an open-source registry software for biological parts (https://registry.jbei.org; *Nucleic Acids Res*. 2012, 40:e141, doi: 10.1093/nar/gks531).

Questions from the audience:

Q: How committed are the UK funding agencies towards *OpenPlant*?

A: They seemed attentive and open to support the venture.

Q: How 'open' will the initiative be (restricted only to the UK)?

A: The prospective database and the accompanying software will be open-source. The physical genetic parts will probably be deposited at *Addgene* (at least, in the initial phase).

The last presentation of the meeting, by *John Morrissey, IE*, featured the scientific background, incentives, and challenges of research with yeasts at the School of Microbiology, University College Cork, within the COST Action FA0907, *BioFlavour* (https://bioflavour.insa-toulouse.fr/), as well as the Marie Curie Initial Training Networks, *YeastCell* (www.yeastcell.eu/) and *QuantFung* (http://www.quantfung.tu-berlin.de/menue/quantfung/). After postulating that yeast be used as a repository for plant enzymes, supporting his argument with examples of successful application of yeast for modular storage and activity testing of P450 cytochromes, the speaker further emphasized the role of yeast in synthetic biology as a platform for plant metabolite production (vanillin produced by *Evolva*, artemisinic acid introduced to the market by *Amyris*). In the concluding remarks of his talk, he proposed possible routes of integration of yeast research within a plant synthetic biology platform for:

- identification and characterization of parts,

- biotransformations to develop (new) metabolites (new variants of plant metabolites or sustainable levels for screening-->*EU-Openscreen*),
- expression of (new synthetic) pathways.

Discussion

identification of needs & shortcomings, recommendations

The final discussion was opened by the MC Chair, *Heribert Warzecha, DE*, who proposed that the prospective repository of DNA parts be the legacy of the *PlantEngine* COST Action. He then asked the participants to expound upon their expectations from such a repository.

Diego Orzaez, ES voiced his concern about depositing the repository (GB parts) at *Addgene*, as postulated by *OpenPlant*, and expressed his preference of the *BioBricks Registry* dual (data/wiki) approach and centralized hosting of all repository elements (physical parts, data, and software).

Sylvestre Marillonnet, DE addressed the issue by arguing that all the aspects of the repository could be centrally managed, but not necessarily 'stored' in one place; cooperation with *Addgene* would simply involve outsourcing the cumbersome delivery procedure.

Diego Orzaez, ES then posed the question of the necessity of establishing a physical repository, asking if perhaps a data repository would be enough.

Heribert Warzecha, DE replied that the need would depend on the interest of the potential users which is rather hard to gauge. He further argued that once the repository was launched, the user interest was bound to increase. As storage of DNA is inexpensive and does not pose any problems, the main concern would, indeed, be dealing with the distribution.

Nicola Patron, UK contended that *Addgene* seemed to provide a perfect starting-point delivery platform (at least for the well-defined individual DNA parts, as the complex multigene pathway constructs are more difficult to characterize and curate).

Charis Cook, UK then suggested that the delivery service offered by *Addgene* was quite expensive and drew the participants' attention to the existing UK *Arabidopsis* repository as a possible alternative.

Nicola Patron, UK replied that *OpenPlant* took the UK repository into consideration, but ultimately rejected it as less stable than *Addgene* (the national government subsidization might end resulting in hiking the prices in the long run). She further argued that the company offered discounts for those who deposited plasmids/parts in the *Addgene* library.

Erko Stackebrandt, DE expressed his concern about *Addgene* seeming to be 'the golden standard', lack of competition, and the possibility of their domination on the market that might lead to increased prices.

Nicola Patron, UK argued that *Addgene* were a non-profit company. She further posited that combining the data repository with appropriate software tools should be a priority (reminding the audience of the aforementioned JBEI-ICE software provider); thus established platform could then be linked to several libraries/sources of physical DNA parts.

John Morrissey, IE, replying to the question about the attitude towards sharing plasmids/constructs within the yeast community and explaining that it was primarily based on the lab-to-lab/person-to-person format, drew the participants' attention to the possible political aspect of establishing such a repository. He proposed that it might be important for the EU to host its own **independent** repository and argued that the US-based *Addgene* might be a temporary solution, while the centralized EU repository should remain a major future goal.

Summing up the discussion points voiced so far, *Diego Orzaez, ES* concluded that *Addgene* could provide temporary assistance with distribution, but other routes should be further explored, e.g., the aforementioned *Centre for Research Communications* of the University of Nottingham (http://crc.nottingham.ac.uk/) as a possible host of the proposed repository. He further confirmed that the data and software integration efforts should take precedence, while other existing initiatives and infrastructure should be further explored and approached with future cooperation in mind - the PSB voice should be heard within the scientific community and beyond.

Ronald Frank, DE then suggested that *PlantEngine* contact and coordinate with *ELIXIR*, a pan-European research infrastructure for biological information (http://www.elixir-europe.org/); the Action should formulate a clear message of broad community collaboration (beyond plant science; possible collaboration with the yeast community) and submit their proposal to *ELIXIR*. He offered to provide contact information of the *ELIXIR* representative (*Nicolas Bromberg*), to further discuss the possible *PlantEngine* participation in the call.

Further, the *EU-Openscreen* representative drew the participants' attention to the strong rumors of the prospective establishment of the European synthetic biology infrastructure and offered to find out who was at the helm of the initiative.

Erko Stackebrandt, DE suggested that *PlantEngine* formulate a clear business plan for the repository set-up before turning to any pan-European initiatives for support.

Nicola Patron, UK then proposed that the business plan could be prepared in cooperation with a small software company - an industrial partner helping figure out the costs as well as actually set the repository up. She mentioned a possibility of such cooperation with a small company in Cambridge.

Concluding the discussion, *Heribert Warzecha, DE* urged the participants to promote the postulated *PlantEngine Repository Initiative* within the scientific community to gauge the prospective user interest and possibilities of future cooperation, to ultimately fulfill the requirements of *Horizon 2020*.