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Abstract	This work package provides a list of European platforms potentially interested in supporting microbial BRC and a summary about how they can help to sustain BRC and better connect them to the bioeconomy.
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Abbreviation key & Glossary

BRC	Biological Resource Centre
CBD	Convention on Biological Diversity
ESFRI	European Strategy Forum for Research Infrastructures
EC	European Commission
GBRCN	Global Biological Resource Centre Network
ECCO	European Culture Collections' Organisation
MIRRI	Microbial Resources Research Infrastructure
OECD	Organisation for Economic Cooperation and Development

Bioeconomy: The Bioeconomy refers to all economic activity derived from scientific and research activity focused on biotechnology specifically the sustainable production and conversion of biomass into a range of food, health, fibre and industrial products and energy.

Biomass: Renewable biomass encompasses any biological material (agriculture, forestry and animal-based including fish) as a product in itself or to be used as raw material.

1 Background and Objectives

Microorganisms (<http://envismadrasuniv.org/micro.htm>) are the basis for all ecosystem processes. Due to their relationship with all plant and animal groups and their abundance (in terms of biomass) in virtually all habitats, man has long exploited this metabolic wealth for food production and preservation, management of pests and pathogens, generating biofuels, monitoring pollutants, cleaning up oil spills, industrial wastewater treatment and for the development of health care applications (i.e. production of medicinal compounds). **Microbial biodiversity is without any doubt a crucial key for the development of the bioeconomy.**

The aim of EMbaRC was to drive the establishment of a self-sustainable community of European Microbial Resource Centres representing a large bio-diversity and offering a wide-range of not only bio-resources but also expert services. Resources and services will enable the development of new partnerships with public institutes in the field of biodiversity and will facilitate revenue-generating partnerships with the economic sector: large agronomic, food or biotech companies, SMEs, NGO's The link with the economic sector can take place directly and locally, each BRC having their own contacts with private companies, this is part of their own sustainable strategy, depending on the type of microbial resources they have. **However, how can a link be made directly at a European scale?** This depends on the field (biotechnology, agronomy, animal health,

food industry, biofuel,....), private companies have their federations or European platforms. The mechanism of how a generic connection can be made between microbial BRCs and the most appropriate of these industrial platforms is the object of this deliverable; it is essential for a BRCs sustainability and its usefulness in the bioeconomy.

To date, the main existing structure regarding microbial BRC at the European level is the European Culture Collections' Organisation (ECCO) which was established in 1981. This organisation promotes collaboration and exchange of ideas and information about all aspects of culture collection activity. The participants of these meetings are made up by more than 90% academics, with the majority being culture collection curators or actors. ECCO meetings are thus very important in connecting collections among themselves, but fails of effectively reachout to "private" or commercial targets. This is logical with the fact that the ambition of ECCO is to federate collections, not to connect them with the bioeconomy sector. The total holdings of the European collections number over 350 000 strains; mainly composed of yeasts, filamentous fungi, bacteria, archaea, virus, phages, plasmids including plasmid bearing strains and other recombinant DNA constructs. This large pool of microorganisms isolated from humans, animals, plants, foodstuffs and the environment represent an invaluable source of innovation; it not only represents a crucial source of reference strains for research but also for industry. Facilitating its exploitation and its connection with the private sector is essential for the future of BRCs and of the GBRCN network (the Global Biological Resource Network (www.gbrcn.org)).

For that purpose, this deliverable lists European institutions / federations in various economical fields concerned with regard to the bioresources present in EMbaRC collections. Then the necessary actions and for which purpose these federations/platform can be reach is presented. This preliminary plan will of course be specifically and deeply developed in the course of MIRRI].

2 List of Platforms

The main biotechnology fields in which microorganisms play a role are:

- Health : human, animal, plant
- Food : quality and safety
- Agronomy
- Preservation of environment : e.g. bioremediation, new energy sources
- Biotechnology including production of metabolites

Some platforms are dedicated to one field whereas some others are transversal. The platforms that should be better aware of European microbial BRCs are presented below.

European Technology Platform: To strengthen the European-wide innovation process, the European Commission has introduced the concept of Technology Platforms whereby relevant stakeholders in key economic sectors commit themselves to working together **to identify the innovation challenge, develop the necessary research programme and implement the results.**

- <http://www.etpgah.eu/>

The **European Technology Platform for Global Animal Health (ETPGAH)** was launched on 16 December 2004 to provide a mechanism for focusing and prioritising the research that ultimately delivers new or improved tools such as **veterinary vaccines and diagnostic tests**.

ETPGAH aims to facilitate and accelerate the **development and distribution of the most effective tools to control animal diseases of major importance to Europe and the rest of the world**. It should thereby improve animal health and welfare, food safety, human health, market access and contribute to achieving the Millennium Development Goals.

The main strategic objectives of the Technology Platform are **to sustain and strengthen the research environment and infrastructure needed to support visionary research into animal health and in particular the epidemic animal diseases and zoonoses**, and to ensure that Europe has a multi-disciplinary strategic research capacity with the core expertise and facilities to anticipate and respond rapidly to new and emerging animal diseases, including zoonoses.

ETPGAH secretariat / c/o Dr. Hervé MARION / Rue Defacqz, 1 / B - 1000 Brussels / BELGIUM
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The Action Plan recognises that the first priority is to identify and prioritise diseases of importance. The second stage is to assess the gaps in the knowledge and understanding of these diseases to identify where research needs to be targeted. With the implementation of the recommendations from these two themes it will be possible to select priority diseases **and identify the research needed to fill the gaps in knowledge**. Once the diseases are successfully prioritised the actions necessary **to develop and deliver new tools for control will be identified and implemented**.

Several microbial BRCs are dedicated to or at least contain pathogen microorganisms, including viruses, involved in animal diseases. These BRCs are crucial at different levels : long term maintenance of strains related to new diseases, furnishing reference strains or a set of strains from various biotopes is essential (to assay vaccines or antibiotics for example on a large spectra of strains).

- www.plantetp.org

The agriculture sector in its entirety is the largest sector of European industry. The sector faces short- and mid-term major challenges such as requirements for greater yields, better and more tailored quality of biomass, and more flexible production conditions. To address **reduced use of natural resources** and climate change is also necessary. European farming and agro-industry is well-positioned to solve these challenges. The best way forward is to develop plants and plans for the future. This requires an integrated action, comprising Research: generating knowledge about plants, their production and their valorisation into products.

'Plants for the Future' ETP aims to mobilise both public and private support at European and national levels. **The stakeholder forum comprises a wide cross-section of companies (1000), research institutions (270) and farmers' organisations (76)**. 'Plants for the Future' is using various instruments to integrate plant sciences with emerging European and national research and innovation strategies.

Address Plant ETP Office : c/o European Seed Association // 23/15 rue du Luxembourg (FR)/ Luxemburgstraat 4 (NL)- 1000 BRUSSELS – Belgium - secretariat@plantetp.org

Plant production and biomass transformation directly concern microorganisms : soil bacteria (essential for plant growth like Rhizobium), phytopathogenic bacteria or fungi, for example microorganisms used in the transformation of biomass into food or biofuel. How microbial BRCs can be involved in solving the challenges evoked and faced within this ETP has to be studied in detail.

<http://www.celcaa.eu/>

CELCAA, the European Liaison Committee for Agricultural and Agri-Food Trade, is the umbrella organisation **representing at the European level, associations and companies active in the sector of agricultural and agri-food trading**.

CELCAA defends the interests of the European agricultural and agri-food sector at the European level, updates members on the latest legislative and technical developments on various policy issues affecting agri-produce trade both at EU and international levels, and addresses horizontal interests without interfering with sector interests of member organisations. CELCAA also works as **a networking platform for its members** to exchange information and expertise and **helps identify the right interlocutors in the sector and in European Institutions**.

Less directly concerned by microbial resources, this platform can help through its networking missions. Microbial BRCs and the services they offer can gain a lot through this platform.

- <http://www.fooddrinkeurope.eu/> and the [European Technology Platform \(ETP\) Food for Life](#)

FoodDrinkEurope coordinates various actions with its members (national federations, European sector associations and major food and drink companies). It was created June 2011, when the Confederation of Food and Drink Industries (CIAA) of the EEC opened a dynamic new chapter in its history by becoming FoodDrinkEurope. The organisation promotes its members' interests in areas such as food safety and science, nutrition and health, consumer trust and choice, competitiveness, and environmental sustainability. On more specific and technical subjects, FoodDrinkEurope also works in close collaboration with other public and private organisations that deal with matters of interest for the food and drink sector. These relations aim to exchange points of view, share objectives, coordinate actions and increase the overall impact of all of FoodDrinkEurope's actions, by making use of potential synergies.

The European Technology Platform (ETP) Food for Life now working under the auspices of FoodDrinkEurope was created in 2005. Its aim is to bring together stakeholders from across the food chain to promote research opportunities and improve knowledge transfer (particularly to SMEs) across Europe. Its activity is structured in 7 pillars: i) Food and Consumer ; ii) Food and Health ; iii) Sustainable Food Production ; iv) Food Safety ; v) Food Quality and Manufacturing ; vi) Food Chain Management ; vi) Communication, Training and Technology Transfer.

Running project is Prometheus (2011 to 2014), aims to reduce consumer exposure to food contaminants, formed during food processing, without impacting on the food's quality or reducing its microbiological safety. **Several food processing technologies are being investigated and new analytical techniques developed. The project should help the industry to innovate by implementing new technologies**

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info@fooddrinkeurope.eu

This ETP Food for life directly concerns microbial BRCs and microorganisms in general. The use of positive microbes or the protection against spoilage or food pathogens microbes is a basic activity of the food industry.

Fermented foods form a large part of the European diet, with dairy products (e.g. cheeses, fermented milks) and also sausage and fermented vegetables. The diversity of food related microorganisms (bacteria, yeast or fungi) is a permanent source of innovation, as technological

properties that provide the characteristics of the final product (such as aroma production, textural changes, gas production) are highly strain dependant. The exploration of strain and species biodiversity for phenotypic properties is very productive in the improvement to processes and can be useful to change the final quality and characteristics of the fermented food. The safety of these products is also of major concern.

In non fermented foods (like seafood or meat, such as carpaccio) a new concept of biopreservation is emerging. Natural positive flora are inoculated on the surface of raw material or on the surface of food (such as seafood) to protect the product from alterations; this improves the duration of storage greatly. Lastly, microorganisms are used in waste water treatment sometimes directly at a food plant level (removing pollutants and producing methane eventually). In all these fields the collaborations with microbial BRCs would be highly valuable.

- <http://www.biofuelstp.eu>

The European Biofuels Technology Platform aims to contribute to the development of cost-competitive world-class biofuel value chains and the creation of a healthy biofuels industry. It also wishes to accelerate the sustainable deployment of biofuels in the European Union, through a process of guidance, prioritisation and promotion of research, technology development and demonstration.

Indeed the European Commission Renewable Energy Directive (2009) states that 10% of transport fuel should be from renewable sources such as biofuels by 2020. Microbes play a crucial role in the production of sustainable biofuels, in particular in second and 'third-generation' biofuels non-food crops. These biofuels are more sustainable than first-generation fuels as they produce higher yields, reduce greenhouse gas production and do not compete with crops grown for food. Two major areas of research are lignocellulosic biofuels and microalgae. Approximately 430 million tons of plant waste is produced from farmland each year which could be recycled in biofuel production.

Address : The EBTP Secretariat is coordinated by Fachagentur Nachwachsende Rohstoffe e.V (FNR, Gülzow, Germany).

As microbes (lignocellulosic, alcohol producers, or microalgae producing oil like substances) play a key role in the development of these new biofuels. The collaboration with microbial BRCs that keep such resources or the creation of dedicated BRCs to biofuel producing microorganisms can be a productive way to support this EC shared goal.

- <http://www.suschem.org>

SusChem is the European Technology Platform for Sustainable Chemistry. It was created in 2004 with the main objective to revitalise and inspire European chemistry and industrial biotechnology research, development and innovation in a sustainable way. Through increasing knowledge of how to modify and use matter at the molecular level, including use of biotechnology and nanotechnology, a future in which chemical research and innovation that brings new, safe, high performance products and services rapidly to market allowing society 'to do more with less' and at a minimal impact on the environment is envisaged.

How microorganisms can support the objectives of this ETP is less immediately obvious. This ETP was cited here as it is an actor of the project BECOTEPS - Bio-Economy Technology Platforms.

- <http://www.forestplatform.org>

The forest-based sector is one of Europe's largest, and includes woodworking industries, pulp and paper industries and printing industries. The Forest Based Sector is becoming a major producer of "green electricity", biofuels and other bio-energy products. In addition to raw materials, forests also provide a wide range of other very important eco-system services.

Forest-based Sector Technology Platform sprl. – FTP - The European Forestry House
66, rue du Luxembourg - BE-1000 Brussels - mail@forestplatform.org

Again the production of new generation biofuel and other bio-energy products from wood is an important active field of research involving microbial resources. Microorganisms can also contribute to a more sustainable use of water in the main water-consuming industries like paper production from wood. For all these reasons, the link between microbial BRCs and the Forest industry can be highly valuable to develop.

- <http://www.eatip.eu/>

The European **Aquaculture Technology and Innovation Platform** (EATiP) is an international non-profit association dedicated to develop aquaculture and, especially, technology and innovate in Europe; in particular to establish a strong relationship between aquaculture and the consumer and to assure a sustainable aquaculture industry.

EATIP - Rue de Paris 9 - B-4020 Liège – Belgium - secretariat@eatip.eu

Among the 8 thematic areas of this platform, at least six can benefit from a closer link to microbial research and resources : i) Product quality, Consumer Safety & Health (through the microbial biopreservation concept) , ii) Technology & Systems ; iii) Managing the Biological Lifecycle ; iv)

*Sustainable Feed Production ; v) Integration with the Environment ; vi) Aquatic Animal Health and Welfare (in connection with animal diseases i.e. pathogenic microorganisms) . Microorganisms are of major importance in industrial wastewater treatment and aquaculture. They reside in the sediment and other substrates, and in the water of aquaculture facilities, as well as in and on the cultured species. Microorganisms may have positive or negative effects on the outcome of aquaculture operations. Positive microbial activities include elimination of toxic materials such as ammonia, nitrite, and hydrogen sulphide, degradation of uneaten feed, and also providing nutrition to aquatic animals such as shrimp, fish etc. These and other functions make microorganisms key players in the health and sustainability of aquaculture (Moriarty D., 2012) . **Yet, microorganisms are among the least known and understood elements in aquaculture. A connection with microbial BRCs preserving the useful resources would be highly valuable at this stage.***

- **Other European Technology platforms of interest for microbial BRCs**

Three other platforms could also be important for microbial BRCs even if the interest is less obvious than for the ones described above.

- ✓ **Agricultural Engineering and Technologies (AET) ManuFuture subplatform** : The mission of the European Technology Platform ManuFuture is to propose, develop and implement a strategy based on Research and Innovation, capable of speeding up the rate of industrial transformation to high-added-value products, processes and services, securing high-skills employment and winning a major share of world Manufacturing output in the future knowledge-driven economy. As a “transversal” platform its link with microbial technology is less easy to identify. However, as one of its objectives is to develop key enabling technologies to **maximise the use of European biomass, as well as** research in the biorefinery field, it might be important to make them aware of microbial BRCs and their services.
- ✓ **European Feed Technology Center (EUFETEC)** The quality and safety of animal feed is a key factor within an integrated European approach for the supply of sufficient, safe, high-quality and healthy foods based on products from animal origin (egg, milk and meat). Microbial resources can contribute to the key priorities of Eufetec which are : more sustainable feed production, with the use of alternative feed sources not yet used; a more sustainable feed consumption with the reduction of feed wastage; an optimised feed conversion rate as a key step towards resource efficiency. It also advocates safer feed in terms of contaminants, whether chemical or biological and also feeds with the composition and appearance that contributes to the maintenance of animal health and that is part of good animal husbandry practices, thus allowing the reduction of the use of antibiotics.

- ✓ **Sustainable Farm Animal Breeding and Reproduction Technology Platform (FABRE TP)**. This platform assesses major issues concerning sustainable animal breeding and reproduction in Europe, taking into account what is happening in the developing world. It aims to mobilize the research, technological development and innovation efforts in Europe, and to bring together key stakeholders around a common vision for the development of the technologies and issues around farm animal breeding and reproduction.

Conclusions about the list of platforms

It must be highlighted that all the ETP platforms described here have been working together for two years in a project funded by the European Commission's Seventh Framework Programme : **BECOTEPS - Bio-Economy Technology Platforms** -Contract KBBE-2008-26526, resulting in a White Paper entitled : "THE EUROPEAN BIOECONOMY In 2030, Delivering Sustainable Growth by addressing the Grand Societal Challenges". They are all key actors of the bioeconomy and in that sense are the first targets for microbial BRCs.

At least the five ETP platforms described above relative to food, biofuels, aquaculture, animal health, and plants are key targets for microbial BRCs. A common strategy would need to be developed to contact these organisations. Individual BRCs may find it difficult to contact them directly so it is recommended here that MIRRI takes up this challenge on their behalf.

3 Rationale for collaborating with European bioindustry Platforms

The first basic objective is to make these platforms **better aware of the existence and roles of European microbial BRCs**. In particular to make them aware that BRCs have many skills that can support their objectives :

- ✚ **Professional maintenance and access to bioresources** for research and innovation, protection of public investment made in the isolation of organisms and the generation of information and knowledge by maintaining the link between the biological material and the information. This includes the preservation of unique resources that do not exist elsewhere (rare resources, disappearing biotopes)
- ✚ To provide **reference strains** of identified species
- ✚ To **offer unique services**, in particular to be centres of excellence for taxonomy; identification of novel organisms and targeting specific chemistry in organisms for further study

The benefits for microbial BRCs to be recognised by ETP as useful actors in the bioeconomy development can be enormous. Above all, this will facilitate BRCs becoming more automatically involved in EC research projects as well as in private R&D projects.

Different ways of contacting these platforms can be envisaged, at a national level (through national mirror groups of these platforms) or directly at an EC level which seems more efficient. EMbaRC and the GBRCN Secretariat leading the microbiology collection community have succeeded in placing the Microbial Resources Research Infrastructure (MIRRI) on the ESFRI roadmap.

MIRRI can certainly act in this direction. However, a preliminary action of ECCO (European Culture Collections' Organization, <http://www.eccosite.org/>) to promote the importance of microbial resources toward these ETP platforms could be very useful to prepare the strategic long term action of MIRRI. This can be achieved by an official letter for example, followed by a visit of an ECCO board delegation to Brussels, as most of these platforms are located in this city. The EC microbial resources could be presented in their diversity and organization and discussions can take place about the needs of the considered sectors to better assess in each case how microbial BRCs can bring added value. Conversely, representatives of the various platforms could be invited to the ECCO annual meeting, which could have a dedicated workshop in order to establish a first direct contact and set a basis for future collaboration between mBRCs and ETP.

4 Conclusion

The network of mBRCs is now strong enough to be an interlocutor to ETP. At least 5 platforms have been identified to be contacted in priority and were presented here. It is essential that the recommendations to MIRRI and ECCO are communicated and taken up.

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Significance of this deliverable

European platforms are key actors, in particular in the field of “research agenda” and for powerful networking between research institutions and stakeholders.

The connection with ETP that encompass microbiology is essential for the sustainable strategy for microbial BRCs. The above review of the existing ETP identifies a large contribution from microorganisms in the various fields considered, **this deliverable highlighted the the prime targets, in order to reinforce the role of microbial BRCs in the bioeconomy development.** Neither the partners nor ECCO have made contact with them to date. This deliverable provides recommendations for the first actions and requires coordinated action from ECCO and MIRRI.