

1.1 Sylvain Brisse (Institut Pasteur) : SA N° 1 Research on pathogenic microorganisms and human / human-animal infectious diseases

1.2 Raquel Hurtado-Ortiz (Institut Pasteur) and Paolo Romano (USMI) : The ISIDORE and BY-COVID projects: The participation of MIRRI to 2 calls of the Horizon Europe program.

Summary ISIDORE project - Raquel Hurtado-Ortiz (Institut Pasteur)

The ongoing COVID-19 pandemic has revealed the vulnerability of the healthcare systems worldwide, including Europe, and the weaknesses of the state of preparedness, resulting from the lack of coordination of all the resources among states and the lack of support for research and development during “peaceful”, non-pandemic times.

A unified and orchestrated strategy involving the research infrastructures is crucially needed for increased responsiveness to SARS-CoV-2 and improved readiness to any epidemic-prone pathogen. In this regard, the 3-years project ISIDORE will contribute to implement Europe’s global service and research capacities reducing the fragmentation and redundancy of initiatives taken for prevention and control of infectious diseases. Notably, two major goals were set: (i) fighting the rise of the SARS-CoV-2 variants *through a global, integrated and challenge-driven approach* and (ii) accelerating the Europe’s response to any epidemic-prone pathogen *through a preparedness-driven approach* by providing trans-national and virtual access to cutting-edge capacities already available in Europe to scientific communities based on the users’ needs.

The development of the ISIDORE project relies on the collaboration of a ‘core consortium’ of 17 research infrastructures (6 EU-funded networks, including EVA, VetBioNet, INFRAVEC, Sonar-Global, TRANSVAC, MIRRI; 1 nationally funded surveillance network, EMERGEN and 10 legally established ESFRI infrastructures, comprising INSTRUCT, EuBi, EU-OS, ECRIN, EATRIS, BBMRI, INFRAFRONTIER, EMBRC, ELIXIR, and ERINHA). The work plan proposed in ISIDORE foresees 16 work packages (WP), spanning from transversal activities (WP1 to WP6) structuring the project and unifying the different RIs to service provision through trans-national access (WP7 to WP16).

Results will be disseminated towards the scientific community through publications, the ISIDORE website and other communications channels (e.g., social media) and will be exploited to raise the awareness of the public through accessible training and general actions, contributing to build trust of the citizens in science

Summary BY-COVID (BeYond COVID) - Paolo Romano (USMI)

The BY-COVID (BeYond-COVID) project is funded by the EU in the context of the ERAvsCorona action plan that already provided relevant outputs, including the establishment of the COVID-19 Data Platform.

The project is worth 12 Million euros and will engage 53 organizations, including 11 Research Infrastructures, for 36 months.

Its main objectives are enabling storage, sharing, access, analysis and processing of research data from outbreak research, mobilising and exposing viral and human infectious disease data from national centres, linking FAIR data and metadata on SARS-CoV-2 and COVID-19, developing digital tools and data analytics for pandemic and outbreak preparedness.

BY-COVID will use and integrate into the European Open Science Cloud (EOSC) as well as into the developing European Health Data Space (EHDS). It also plans to closely collaborate with the parallel project ISIDORE (Integrated Services for Infectious Disease Outbreak Research).

MIRRI partners involved in the project are the Ospedale Policlinico San Martino (HSM), the Istituto Zooprofilattico Sperimentale delle Venezie (IZSVE) and the Istituto Zooprofilattico Sperimentale della Lombardia e dell'Emilia Romagna (IZSLER). Their activity will be mainly carried out in the context of WP2 "Accessing heterogeneous data across domains" (especially T2.1 Non-patient related data sources that also aims at building a substantial link between BY-COVID and ISIDORE) and of WP6 "Engage and build capacity with national and international stakeholders" (especially T6.1 Exchange knowledge on surveillance systems for pathogens and T6.3 Engage with intergovernmental policy-makers and funders).

2.1 Nelson Lima (MUM/U Minho) : SA N°2 Research & Development of new (bio) pharmaceuticals / therapeutic solutions

2.2 Juan Luis Gomez (BEA) : Current status of microalgae as a source of biologically active compounds

Microalgae and cyanobacteria are increasingly attracting considerable interest worldwide, due to their extensive application potential in the biopharmaceutical and nutraceutical industries as renewable, sustainable, and economical sources of bioactive medicinal products and functional food ingredients. In this sense, several strains from the Spanish Bank of Algae (BEA) catalogue have been investigated for their potential as value-added products with remarkable pharmacological and biological active compounds. BEA presents the current status of the selection, cultivation conditions, production and valorization of various bioactive compounds done in consortium with its pharmaceutical and nutraceutical stakeholders.

3.1 Rosa Aznar (CECT/UVEG) : SA N° 3 Research & Development of new, safe, healthy and sustainable food and feed products.

3.2 Michel-Yves Mistou (INRAe-CIRM) : Involvement of BRCs in food science innovations, example of the FLEGME project for the characterization of microbiota associated with fermented vegetables

Consumers are looking natural, safe, and sustainable products in their plates associated with new tastes and innovative products. In that context, the fermentation of vegetables finds a new interest. The FLEGME project aims to characterize the microbiota associated with fermented vegetables processed at home by citizens who become research actors and contribute to food science through their experimentations. Microbial BRCs of the CIRM, led this project and are in charge of the microbiota characterization through metagenomics and of the isolation, collection and conservation of bacterial and yeast strains. These isolates, available for research, can be of great interest for the agrofood industry always looking for new processes and new products to follow the market trends.

4.1 Paris Laskaris (NKUA) : SA N°4 - Resources and methods for biological management of soils and crops

4.2 Sylvie Cranenbrouck (BCCM - MUC - UC Louvain) : Arbuscular mycorrhizal fungi: key

organisms for improving crop production

Agriculture is faced with the need to produce more with less input of fertilizers, especially nitrogen and phosphorus, under conditions of reduced or more variable water availability and often under conditions increasing parasite pressure. The increase in fertilizers, pesticides, irrigation will represent a major economic cost and a threat to the environment. The challenges that agriculture must face to feed the future population are thus becoming more and more pressing. Their achievement will require far-reaching solutions, including (1) improved varieties with higher yields, (2) increase in efficiency of use of N, P and water (3) increasing resistance to stress (salinity, drought, pests, diseases) (4) the conversion of marginal lands into productive areas and the restoration of degraded areas, (5) optimal use of agricultural inputs (e.g. fertilizers, pesticides) without increasing the impact on the environment. There is thus a need for a new approach amongst which is the use of beneficial microorganisms, including, among others, arbuscular mycorrhizal fungi. In this video (the infinity small at the service of humanity) we emphasize the importance of these microorganisms and how they could be managed in cultures collections and used in the field at the service of agriculture.

5.1 Cristina Varese (UNITO) : SA N°5 - Resources and methods for biomonitoring and/or bioremediation of microbial pathogens, persistent organic pollutants and plastics in soils and waters

5.2 Maria Kuyukina, Irina Ivshina (PFRC UB RAS) : Collaborative work experience in the field of oil bioremediation with industrial partners

The authors have been engaged for many years in the bacteriology of hydrocarbon degradation, the search for and study of new oil-degrading strains and ways of their long-term biotechnological exploitation. They are well experienced in the collection work and in this presentation they make an attempt to focus the attention of potential users to the bioresources of a specialized collection of microorganisms isolated from numerous habitats in contrasting ecological and climatic zones and are promising for use in bioremediation of oil-contaminated ecosystems.

The Regional Collection of Alkanotrophic Microorganisms (acronym IEGM, <http://iegmcol.ru>) operating in the Urals, one of the Russia's promising oil and gas production regions, is a center for comprehensive research of ecologically significant hydrocarbon-oxidizing actinomycetes of the genus *Rhodococcus*.

Rhodococci have a rare property of utilizing higher gaseous methane homologues (propane, *n*-butane) along with liquid hydrocarbons as a sole carbon source. They dominate in the biotopes of oil-polluted areas and play a key role in the processes of natural biodegradation of petroleum hydrocarbons.

The collection possesses a variety of strains capable of biodegrading hydrocarbons of different classes, individual fractions of crude oil, petroleum products, and emerging pollutants. The collection strains can tolerate high concentrations of organic solvents, heavy metals, and are active in a wide range of extreme temperatures, pH, and salinity.

Comprehensively characterized strains with biodegrading abilities towards crude oil and petroleum products were used to design stable immobilized biocatalysts, which preserve their target functional activities for 8 months or more, and thus meeting the requirements of the market. These biocatalysts laid the basis of the developed series of bacterial

preparations with hydrocarbon-oxidizing potential and nature-like technologies. They find their applications in bioremediation of oil-contaminated soils performed under contracts with companies involved in environmental remediation business. A flexible flow-chart for integrated bioremediation techniques has been developed and patented, and then adapted for application in cold climate regions.

Examples of long-term cooperation with strategic partners on biodegradation of solid oily sludge, oily waste and heavy petrochemical waste are given. Experience shows that without the entrepreneurial training in the field of technology and innovation management, it is impossible to avoid unfair distribution of benefits arising from the use of intellectual property. However, we are pleased with the effective results obtained when using R&D based on the IEGM collection bioresources.

6.1 Craig Faulds (INRAe CIRM-CF) : SA N° 6 Research & Development of renewable biobased chemicals, materials and bioenergy sources

6.2 Ronald de Vries (KNAW) : Bioconversion of lignin derived aromatics compounds into platform chemicals

Lignin is a highly complex and recalcitrant component of the plant cell wall and a major waste stream from many biobased processes. Depolymerization of lignin is achieved most efficiently using chemical treatment, which however results in a wide range of monomeric aromatic compounds, which complicates the application of this fraction for the generation of valuable products.

In recent years we have dissected the aromatic metabolism of fungi, in particular *Aspergillus niger*, by a combination of genome and transcriptome analysis, gene deletion strains and biochemical characterization of the candidate enzymes. This resulted not only in the identification of many of the pathway genes, but also provided leads for metabolic engineering of fungi to be used as aromatic cell factories. By blocking specific steps in the pathway we showed that mixtures of aromatic compounds can be converted to a single compound that can be used as a platform chemical for industry, such as protocatechuic or vanillic acid.

7.1 Gerard Verkleij (KNAW) : SA N°7 Rescuing and preserving microbial biodiversity

7.2 Benedetta Turchetti (DBVPG) : Preserving yeast diversity from worldwide endangered cold habitats in the era of climatic change: scenarios and challenges

Global warming is one of the main effects of worldwide climate change driven by the enhancement of greenhouse gas (CO_2 and CH_4) emission. Global temperature has risen by 0.85°C in the period 1880-2012 and by 2100 it is predicted to increase by $1\text{-}3.7^\circ\text{C}$. More notable enhancement of temperature is expected on terrestrial regions than over the oceans. This will result in the modification (and even the loss) of many habitats. Among them, Arctic, Antarctic and mountain glaciers can be regarded as climate change hotspots, due to the presence of a resident psychrophilic and psychrotolerant biological diversity, which is evolved and adapted to cold and are therefore extremely vulnerable to the increase

of temperatures.

As a consequence, because of the global warming, cold habitats are regarded as endangered ecosystems. Furthermore, these habitats are among the most under sampled, notwithstanding they apparently still retain a large portion of global cold-adapted microbial diversity.

A number of ecological studies on these extreme habitats often reports the isolation of yeasts belonging to new (not described so far) genera and species. The studies on cold-adapted yeast diversity carried out in Antarctica and European glaciers by the Industrial Yeasts Collection DBVPG in the last 15 years, the following new genera and species were described: *Mrakia robertii* sp. nov., *Mrakia blollopis* sp. nov., *Mrakiella niccombsii* sp. nov. (now renamed as *Mrakia niccombsii*), *Glaciozyma* gen. nov., *Glaciozyma martinii* sp. nov., *Glaciozyma watsonii* sp. nov., *Taphrina antarctica* f.a. sp. nov., *Cryptococcus vaghanmartinae* sp. nov. (now renamed as *Naganishia vaghanmartinae*), *Cryptococcus onofrii* sp. nov. (now renamed as *Naganishia onofrii*), *Dioszegia patagonica* sp. nov., *Cystobasidium alpinum* sp. nov., *Vustinia* gen. nov., *Vustinia terrae* sp. nov., *Heterocephalacria gelida* f.a. sp. nov., *Piskurozyma silvicultrix* sp. nov., *Naganishia nivalis* sp. nov.

Cold environments have selected for millennia specific yeasts species which evolved peculiar physiologic and metabolic adaptations to overcome the adverse effects on cell physiology of extreme low temperatures. As a consequence, the *ex-situ* preservation, as well as description and characterization of the above new cold-adapted yeast genera and species has not only showed a significant taxonomical value but also interesting biotechnological potentialities due to the features associated to their adaptation strategies such as production of cold active enzymes and of polyunsaturated fatty acids.