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Report on a platform for microbiome research and innovation in Medicon Valley

Report to The Microbiome Signature Project by KPMG

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Executive summary

The microbiome has gone mainstream in recent years as evidence on its key role in human health and treatment prediction becomes unequivocal. As interest in the microbiome grows, research fields are expanding into areas such as animals, food and agriculture. Various stakeholders across academia, industry, philanthropy and government are keen to take the topic forward.

One example is the Microbiome Signature Project (MSP), which has mapped the existing capacities in the greater Copenhagen region in research, clinical studies and commercialization in the area of the human, animal and plant-related microbiome. **Medicon Valley Alliance** (MVA), **Copenhagen Capacity** and **Invest in Skåne** – the key MSP partners – wanted to build on this mapping exercise and explore longer-term prospects for a microbiome initiative for the life science cluster of the greater Copenhagen region, known as Medicon Valley.

Specifically, the Microbiome Signature Project wanted to:

- Identify the demand for a microbiome hub
- Uncover key success factors
- Develop strategic recommendations

The KPMG Life Sciences Strategy team was commissioned to explore these three aims. In a first step, ten successful microbiome initiatives were investigated via desktop research. Four of these were then analyzed in depth based on interviews with the founders and managers of the initiatives. Insights were further enhanced by six interviews with internal stakeholders from industry and academia, which added fresh perspectives and more details about current challenges.

The initiatives vary significantly in terms of their reach and purpose, with some aimed at advancing basic scientific insights into the microbiome in specific areas and others at strengthening the commercialization of discoveries through industry collaboration. The vision and mission statement of the initiatives also reflects a wide range, from early-stage international scientific microbiome networks to established organizations seeking to become the world leader in commercialization of microbiome-related applications. Most of the initiatives have the human microbiome as their key focus area. All initiatives investigated have as a primary goal the initiation of collaboration between researchers, clinics and the industry and create an impact by adopting the mindset “the whole is more than the sum of its parts”.

This is reflected in shared physical research infrastructure or in virtual tools such as databases and libraries, for example.

With regard to a microbiome initiative in Medicon Valley, internal stakeholders flagged as a key challenge the lack of collaboration, which is attributed to the absence of a structured organization. When asked about key assets, they mentioned solid capacities for commercialization of scientific discoveries thanks to strong clinical capacities and the availability of patient data as well as the attractiveness of the entire region for scientific talents.

The analysis of the ten hubs along with key stakeholder interviews revealed a set of important factors to be taken into consideration when a planning microbiome hub. For example, successful strategic initiatives support the creation of a strong brand that enhances the unique selling proposition (USP). A well-defined communication strategy raises awareness and educates the public, especially if it triggers a “fear of missing out”. Potential collaborators from academia, industry, philanthropic institutes, and government need to see the added value of the initiative and want to participate and support it. Recommended ways to facilitate collaboration include installing shared PhD programs or shared research infrastructure. Dedicated and professional management resources, preferably with prior experience in management of comparable initiatives, is crucial for the success of a hub, as is a solid financial basis of the initiative.

As a next step, the MSP partners and related stakeholders for the microbiome initiative should discuss the direction to be taken at important “crossroads”. For example, the stakeholders should decide whether they want to have a strong focus on basic research or if the initiative should concentrate instead on applied, translational and clinical research. The stakeholders have to agree on financing strategy. They should decide whether collaboration with an existing hub outside of Medicon Valley would be an option and whether the microbiome initiative should become a fully developed hub with its own infrastructure. They should ask themselves whether they are willing to accept that certain functions are centralized in specific locations or if they would prefer a decentralized organization.

They should also discuss who should be in the lead for defining and implementing a communication, branding, outreach strategy. In order to initiate a discussion among stakeholders on possible actionable options for starting an initiative, KPMG has outlined four different options on how to start the planning of a microbiome hub in Medicon Valley. They can be summarized as follows:

- **Option 1:** Creating public awareness for the microbiome before starting with the design of a microbiome initiative
- **Option 2:** Seeking external experience before beginning the detailed planning phase
- **Option 3:** Developing a collaboration model with an existing hub, e.g., in the USA
- **Option 4:** Focusing on industry collaboration and translational research from the outset

Introduction

Introduction

Medicon Valley and the Microbiome Signature Project

Medicon Valley is a bi-national Life Sciences cluster spanning the greater Copenhagen region (eastern Denmark and the southern part of Sweden). It includes more than 350 biotech, medtech and pharma companies with local research and development (R&D) activities, as well as leading universities and clinics. A flagship project of Medicon Valley is the Microbiome Signature Project (MSP), which aims to position the greater Copenhagen region as a global center for microbiome research into the human, animal and plant-related microbiome. The three-year project is jointly led by **Medicon Valley Alliance** (MVA), **Copenhagen Capacity** and **Invest in Skåne**, and is co-financed by the EU program Interreg Öresund-Kattegat-Skagerrak.

MSP aims to strengthen the greater Copenhagen region's research environment within the microbiome field by enhancing collaboration and synergies across borders and across disciplines. It also seeks to boost private investments in research and innovation through the establishment of international research facilities and activities, as well as measures to attract talent to both publicly and privately funded research environments.

In a "triple helix structure", the MSP partnership (Medicon Valley Alliance, Copenhagen Capacity and Invest in Skåne) has engaged with more than 40 regional stakeholders in Medicon Valley from industry, academia and clinical environments in the research area of the microbiome. The different industry and academic partners active in the area of microbiome have been mapped and listed on the MSP homepage: Microbiome Signature Project

The MSP homepage also explains how to obtain information on ongoing scientific projects, collaboration opportunities with local industry partners and direct investment projects.

MSP runs from 2019 to September 2022. Before the project closes, the MSP partnership wanted to capitalize on the insights gained. In particular, the partners are seeking options for a longer-term perspective on how to facilitate and structure collaborations in microbiome research and innovation across universities, clinical environments and companies beyond the project period.

Ensuring that the outcomes of MSP are maintained and sustained once the project draws to a close is also a requirement of the project sponsor, the European Regional Development Fund (Interreg V).

The MSP partnership is particularly interested in exploring pathways for Medicon Valley to become a leading microbiome research and innovation cluster by establishing a research collaboration platform.

Against this background, the MSP partnership has engaged KPMG to identify a number of existing microbiome initiatives and explore their key success factors such as scientific focus and processes for collaboration, along with their governance and finance models. Based on desktop research and interviews with representatives of the hubs and selected key MSP stakeholders, KPMG was asked to draft a report providing views on possible collaboration models, scientific focus, governance and financing, and possible service offerings. The report findings should be used to inspire the design of a research collaboration platform.

Content and purpose of the report

The MSP partnership would like to obtain a brief overview on the vision/mission/aims of ten representative microbiome initiatives in the USA and Europe as well as on their key focus areas and how they interact with their partners.

Out of these ten initiatives, four research platforms/hubs should be selected for a detailed benchmarking study with a focus on research collaboration, governance, operating model, financing and types of services provided by the hubs.

Methodology

The project is structured in four phases:

I. Identification of ten leading microbiome hubs in the USA and Europe, accompanied by subsequent secondary data collection and compilation of data in a table. Hubs were selected in collaboration with the MSP partnership according to different criteria relevant for gaining insights into setting up a bi-national research platform.

II. Selection of four microbiome hubs out of the ten hubs for further primary data collection **through 60-90 min structured interviews with senior executives or management**. Topics to be discussed are best practices, key success factors, value proposition, challenges and learnings from failure.

III. Additional primary data collection **through six structured 60-90 min discussion with stakeholders based in Medicon Valley** and other microbiome experts from academia and the industry on opportunities and challenges associated with a regional microbiome research platform.

IV. Compilation of findings from desktop research, one-to-one interviews and discussion of various options and **possible recommendations (inspiration) for the development of a strategy** on a microbiome research initiative in the greater Copenhagen region

Selected microbiome initiatives (platforms/hubs) in Europe and the USA

Research into the microbiome is a current trend in biology and pharmacology. A total of 35 microbiome initiatives have been identified, mainly from the USA, Europe and rest of the world. The initiatives focus on fostering scientific and clinical research as well as collaboration with the industry in this area. Such initiatives come in many different organizational forms, with different goals and mandates and with different sources of financing.

Some initiatives are structured as **research platforms** without proprietary physical infrastructure. Often, they span regions or, in certain cases, states and are sometimes set up for a fixed period of time. They are mostly designed for kick-starting scientific excellence and research collaboration, and accelerating spin-offs and industry cooperation. They tend to rely on existing research infrastructure from the platform partners. Some also focus on attracting talent and investments to their regions.

Other initiatives are unlimited in duration and in some cases have already been active for many years; longer-term initiatives have been undergoing transformational processes to adapt to changing requirements from their stakeholders and the shifting commercial and scientific environment. Sometimes they run their own physical infrastructure, which gives them more of a **research hub** character. Along with their physical presence, they often also have regional economic development focus, reflected, for example, in the creation of spin-offs, support for industry collaboration and fostering of scientific advancements.

A key differentiator between the different initiatives is the type of services and/or access to research facilities offered to both local partners/stakeholders and external partners/stakeholders.

Out of the 35 microbiome initiatives identified in Europe and the USA, ten hubs/research platforms were selected for a desktop research-based analysis. For a sub-group of four platforms/hubs, one-to-one interviews were conducted in addition to desktop research. Each hub or platform was selected on account of one or several specific features conducive to obtaining a broad overview of different approaches for establishing and running microbiome initiatives. The decisions considered geographical, organizational and thematic points of view. For this reason, one of the initiatives included into the sample does not have a particular focus on the microbiome but does enjoy a strong track record in fostering cross-national scientific collaboration.

Research platform or hub?

Research platforms predominantly focus on fostering collaborative research between different academic departments and institutions by enabling the creation networks of researchers. Examples include the Swiss National Centre of Competences in Research (NCCR) or the Million Microbiomes from Humans Project (MMHP). They often do not have specific proprietary infrastructure. There is less of a regional focus, and the platform leadership team is often spread over different locations.

Research hubs have a greater degree of institutionalization than research platforms. They focus on basic or applied research. In addition, they run their own physical infrastructure which leads to a stronger regional development focus. They also aim at attracting talents and investments to one or several locations within the scope of their initiative.

Six microbiome initiatives selected for desktop research only

The following six hubs or platforms have been selected for desktop research only:

EMBL – European Molecular Biology Laboratory, Heidelberg, Germany

EMBL includes 110 independent research groups and service teams covering the full spectrum of molecular biology. EMBL runs research sites at different locations across the European Union.

Reason for inclusion: Despite the microbiome being only a small part of their research focus, EMBL is an excellent example of an internationally well-respected initiative for EU-wide scientific collaboration.

INRAE – French National Research Institute for Agriculture, Food and Environment, Paris, France

INRAE's mission is to produce and share scientific knowledge and contribute to solving major challenges in Europe and in the world concerning agriculture, food and the environment.

Reason for inclusion: INRAE enjoys a strong network within France and is internationally well-recognized.

MIN – Microbiome Innovation Network UK, London, UK

MIN is a newly established microbiome network spanning the whole of the UK. With a clearly defined strategic outlook, it connects several universities, research institutes and industries.

Reason for inclusion: MIN is one of the largest networks in the microbiome space.

CMIT – Center for Microbiome, Informatics and Therapeutics, Boston, USA

CMIT is a good example of an American research center from a single university that solely focuses on research, service provision and attraction of talents.

Reason for inclusion: CMIT represents one of the many research centers affiliated to a single university in the USA.

MMHP – Million Microbiomes from Humans Project, different locations globally

MMHP is a large organizational commitment from several countries all over the world to fulfill their aim. It is a virtual network with beneficial services for members.

Reason for inclusion: MMHP is an international research platform that gathers together several universities and research institutes to reach one goal.

FHU – PaCeMM – Fédération Hospitalo-Universitaire: Paris Center for Microbiome Medicine, Paris, France

FHU – PaCeMM is a regional hub in the Paris area with strong connections between hospitals and research groups. It has a clearly defined strategy for the next five years.

Reason for inclusion: FHU represents a regional hub with a clear strategic focus.

The next chapter provides a brief overview of the six microbiome research platforms/hubs, including their vision, mission and aims for microbiome research.

Four microbiome initiatives selected for detailed analysis, including desktop research and one-to-one interviews

APC – The Alimentary Pharmabiotic Centre Microbiome Ireland, Cork, Ireland

APC is the oldest established microbiome hub, founded in 2003 with a track record of success and a long-term relationship to industry.

Reason for inclusion in detailed analysis: APC created a successful hub and has proved its relevance given its long-term existence.

CRC 1182 – Collaborative Research Center 1182 – Origin and Function of Metaorganisms, Kiel, Germany

CRC is an association of several universities in a cutting-edge research cluster funded by the German government. Within the organization shared services represent a core activity to facilitate collaborations.

Reason for inclusion in detailed analysis: CRC represents a conventional research hub funded by the state and has shared services that are connected to the research groups.

EMC – Euregional Microbiome Center, Maastricht, Netherlands

EMC is a tri-national hub that includes universities in the founding states of the Netherlands, Belgium and Germany, which have faced the challenge of working across borders.

Reason for inclusion in detailed analysis: EMC is a hub spread over three geographically close nations.

NCCR Microbiome – Swiss National Centre of Competence in Research Microbiomes, across Switzerland

NCCR is a fledgling academic network of six Swiss universities that aims to bring interdisciplinary research together.

Reason for inclusion in detailed analysis: NCCR is a recently founded, purely academic network with highly regulated governance.

Overall, 35 hubs were identified but not further explored. There is an emerging trend among individual universities all over the globe, especially in the USA, to build research centers for microbiome research. These universities represent single research institutes and appear not to be clearly connected to other universities through a common ecosystem. Other reasons why such hubs were excluded are that they are less relevant for the aim of the current study due to their small size, recent foundation, lack of an established microbiome initiative or different focus of research or intention.

Summary

Initiative	Locations	Partners	Founded	Type	Range
EMBL	6 research institutes spread across Germany, France, Spain, Italy, UK	Academia Industry	1974	Hub	EU-wide
INRAE	18 research institutes across the whole of France	Academia Industry	2020	Hub	National
MIN	Across the whole of the UK	Academia Industry	2014	Hybrid	National
FHU – PaCeMM	Paris, France	Academia Industry (planned)	2020	Hybrid	Regional
MMHP	Virtual network spread across Sweden, France, Denmark, Latvia, the Netherlands, China	Academia Industry	2021	Platform	International
CMIT	Boston, MA, USA	Academia	2014	Hub	Regional
APC	Cork & Teagasc, Ireland	Academia Industry	2003	Hub	National
CRC	Kiel. Germany	Academia	2016	Hub	Regional
EMC	Netherlands, Belgium, Germany	Academia Industry (planned)	2021	Hub	Tri-national/ Regional
NCCR	Across whole Switzerland	Academia Industry (planned)	2020	Hybrid	National

Overview of ten selected microbiome initiatives

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Overview

The analysis of the ten microbiome initiatives selected for desktop research, focused on three areas:

- Mission statement (vision/mission/aims)
- Key scientific areas
- Collaboration with partners and service offerings

Six of the ten initiatives can be considered a type of hub: an **individual research hub or a network of research hubs**. This is because they have a **regional/national** focus and regional/national/EU-wide proprietary research infrastructure: EMBL across Europe, INRAE across France, APC in Ireland, CRC in Germany, EMC in Germany, Netherlands, and Belgium, and CMIT in Boston. Their partners are mostly regional or national (or EU-wide) universities research institutes, hospitals, or industries. One of the explicit or implicit goals are that their activities reach beyond advancements of scientific excellence in their territory, and they generate long-term positive impact on socioeconomic factors such as investments, job growth and international competitiveness.

Only one initiative – MMHP – can be considered a **pure research platform**. MMHP is developing an international research platform fully dedicated creating the world's largest database of the human microbiome. MHHP has no physical focal point but rather a **global focus** and is fully virtual. Its partners are from China and Europe. Consequently, MHHP has **not developed any regional ambitions** (albeit the individual partners might, through their participation in MMHP, indirectly generate long-term positive impact in the region where they are located). Other hubs such as CMIT offer different services too; however, this is not the main purpose of the research institute in Boston.

FHU – PaCeMM in Paris, MIN in the UK and NCCR in Switzerland are **hybrid**: They do not (yet, at least) have a dedicated physical infrastructure. They operate as a facilitator for scientific collaboration and technology transfer for the greater good. While FHU – PaCeMM is focused on the Greater Paris Area, MIN encompasses the entire UK, and NCCR the whole of Switzerland. But their goals are **clearly regional/national**. All three initiatives focus on fostering regional or national scientific advancements and collaboration with the private sector, i.e., for research or commercialization in the area of the microbiome.

Microbiome initiatives are a fairly recent development. Apart from APC, none of the initiatives is older than 10 years, which comes as no surprise given that this research field itself is quite new. Four of them have been launched in the past years, and at least two of them (CRC and NCCR) have a predefined timespan due to the nature of the long-term research initiative fostered by the state.

Mission statements (vision/mission/aims)

The vision, mission and aims explain the initiatives' long-term view for their future, as well as planned mid-term and short-term actionable steps. Looking at the mission statements of the ten different initiatives, there is a difference between those with global ambitions and those seeing a geographic limit to their field of activities. The focus of the initiatives is further distinguished by scientific and technological advancement or socioeconomic factors.

MMHP has given itself a **global scientific mission** to create a microbiome database which will be made available to a global research community. Even if CMIT, is coming from a single university in Boston, it has **global ambitions** to create a microbiome conservancy, while its partners are mostly local.

The eight other initiatives have mission statements which circle around the development of **regional, national or pan-EU goals**, mostly with focus on research collaboration. MIN and APC are exceptions since their primary mission involves being embedded in the nation's economy and becoming a world leader, supporting technology transfer and progressing towards industrialization. They set themselves similarly ambitious goals to make the UK and Ireland, respectively, a global center for discoveries and commercialization in the microbiome space. Recently launched initiatives clearly have other priorities such as **creating and establishing an active scientific microbiome community**, as is the case with NCCR and EMC. This contrasts with CRC or FHU – PaCeMM, which both have a strong community in their respective region and are much more **based on fundamental and applied research**. From a scientific perspective, CRC has a very broad focus on a wide range of organisms, broken down into common and distinct fundamental principles. FHU – PaCeMM dedicates their mission statement and scientific

focus to promoting and improving fecal microbiota transplants.

Key scientific areas

Regarding the **focus of research**, there are initiatives that dedicate only a small proportion of their activities to microbiome research, whereas others focus entirely on this field. MIN, APC, FHU – PaCeMM, MMHP, CMIT, EMC and NCCR are all about microbiome research in humans, animals, plants and food science, how to improve it and how to benefit from it. MIN has not only a broad approach for supporting microbiome research, but it also works on further developing and establishing standards, guidelines and protocols for research and biobanking storage. This makes sense since MIN has a strong focus on economic and commercial aspects rather than on specific microbiome research areas. For INRAE, CRC and EMBL, microbiome research is part of their (wider) research interests. INRAE is generally interested in agroecology, bioeconomy and society, while CRC explores the general interaction between microbiota and several different organisms. EMBL focuses on broad fundamental molecular Life Sciences including the microbiome.

Collaboration with partners and service offerings

Collaborations and partnerships represent the heart of a hub. Research groups must work together to add value to their research which would be missed without the collaborations. But this is not true only of research groups from similar fields. The trend is moving towards interdisciplinary research in which classical borders of science dissolve. All hubs have in common that they foster interdisciplinary research. EMC was created after initial established regional collaborations and grew in an entrepreneurial spirit. The degree of collaboration between the different partners depends to a certain degree on the existence of proprietary research infrastructure or commonly developed tools such as libraries or databases.

The vital core of all initiatives is the relationship between members, which are mostly universities. Almost all initiatives are composed of universities or research institutes. Exceptions are CMIT, which is a single institute but works together with other departments, and MIN, which also includes industries in its network.

Another important aspect is the collaboration with industry. Here MIN and APC are obvious frontrunners with clear focus on commercialization and how to support businesses of all sizes. APC, EMBL, NCCR and INRAE have fully developed technology transfer offices or at least a supportive function, while FHU – PaCeMM mentions on its website that it is open for industry collaboration. No indication of possible industry collaboration can however be found on the website MMHP and CMIT. However, MMHP invites other research groups to join its research project and contribute with samples to be part of the million sequenced genomes. CRC is a fundamental research cluster funded by the government and cannot have industry collaborations, which might be even counterproductive for their reputation. EMC and NCCR do not currently have bigger collaborations outside their network but these are planned for the future.

Collaboration between partners through shared or centralized research infrastructure is one of core elements of initiatives such as EMBL, INRAE, MMHP, CMIT, APC and CRC. Initiatives such as FHU – PaCeMM in Paris and MIN in the UK, which do not offer such shared infrastructure, came up with alternative services in order to make themselves attractive for their partners. For instance, MIN has a special focus on support for fundraising and commercialization, while APC offers an organized scientific service for internal use that will be billed and automatically transferred to the research groups. EMC and NCCR do not yet have infrastructure in place but are planning to develop it. However, EMC divides work according to the expertise of the labs in common research projects and has already had successful experience with shared PhD students. PhD students have more than one dedicated principal investigator (PI) and move across labs to gain more experience.

EMBL – European Molecular Biology Laboratory, across Europe

With 27 member states, laboratories at six sites across Europe (Germany, France, Spain, Italy, the UK) and thousands of scientists and engineers working together, **EMBL** is a powerhouse of biological expertise. Headquartered in Heidelberg, Germany, EMBL is an intergovernmental organization and was founded in 1974. Form an organizational point of view, EMBL can be qualified as a network of research hubs with proprietary infrastructure and with an EU-wide focus. Microbiome research is one aspect of the work at EMBL but there is no specific focus on microbiome research.

- EMBL's **vision** is to advance understanding of ecosystems at the molecular level and study life in context. EMBL mission is the promotion of molecular life science research in Europe, training young scientists, and developing new technologies and to fosters International Relations across Europe and worldwide.
- EMBL's **key scientific areas** are in fundamental research of the ecosystem with molecular biological techniques in Life Sciences. EMBL has different research units across the entire spectrum of biological research. A special focus is on interdisciplinary research and on collaboration with external institutions of comparable standard, vision, and international orientation.
- **Partners and services**: Through its different institutes, EMBL provides life science researchers in Europe and beyond with access to the very latest in scientific technologies, research infrastructure, data resource tools, structural imaging, chemical biology, etc. Wherever possible data resources, databases, tools, and software are freely available to the scientific community.
- **Collaboration with industry and startups**: EMBL has partnerships with the industry including most of the 20 pharma companies and many more. EMBL has an extensive partnership program with leading pharma companies. EMBL Enterprise Management Technology Transfers identifies, protects, and commercializes intellectual property developed at EMBL. EMBL Ventures invests throughout Europe to build companies that create significant commercial opportunities.

Conclusion

EMBL is a large and established **network of research hubs** with focus on basic research in Life Sciences and with centralized activities in technology transfer. Microbiome research is included. EMBL offers access to its proprietary research infrastructure to researchers. EMBL is an internationally well-recognized research institute that offers scientific services and advanced training.

INRAE – Institut National De La Recherche Agronomique, Paris, France

INRAE is France's new National Research Institute for Agriculture, Food and Environment, created in 2020. It was formed by the merger of INRA, the National Institute for Agricultural Research, and IRSTEA, the National Research Institute of Science and Technology for the Environment and Agriculture. INRAE connects research institutions through the whole of France. The focus relies on sustainability and becoming a relevant regulatory player for the governmental authorities. Microbiome research is part of the Microbiology and Food Chain division, one of 14 research divisions overall. INRAE consists of 18 research institutes located in several regions in and outside of France. INRAE is a network of research hubs with proprietary infrastructure and a focus on advancing the sciences in France.

- The **vision** of INRAE as outlined in "INRAE 2030" is to build a sustainable future through shared science and innovation. INRAE's **mission** is to produce and share scientific knowledge and contribute to solve major challenges in Europe and in the world concerning agriculture, food and the environment. Fostering innovation, expertise and support public policy maker at international, European, and national level represents another pillar of INRAE's mission statement. INREA's scientific priorities (**goals**) are focused environmental challenges and the transformation of the economy to a bioeconomy. Policy goals focus on public outreach and governmental relations.
- INRAE's **key scientific areas** are all related to agroecology and the transition towards an ecologically and socially sustainable agriculture. Topics include environmental challenges in food production, promoting a holistic approach to health, and digitalization. MetaGenoPolis is an INREA laboratory expert in gut microbiome research. In addition, research into the plant microbiome is part of Microbiology and Food Chain division.
- **Partners and services**: INRAE comprises more than 202 research units, 43 experimental units, 22 service units and 10 metaprograms. It collaborates closely with regional authorities, and regional technical institutes. INRAE has a large **industry partnership** program with over 450 industry partners. INRAE has a strong focus on open access research infrastructure. INRAE's research infrastructures supply scientific communities with data production and processing services, along with support for training, innovation and the development of technology, including sample management and storage, quantitative genomics, and functional metagenomics. Services are also offered to external customers. INRAE is member of several joint technology networks. INRAE Transfer is a technology transfer and project engineering company that promotes innovations in food, agriculture and the environment.

Conclusion

INRAE is an established national **network of research hubs** across France with a focus on agriculture Through its long-term mission statement INRAE is committed to integrating environmental and social goals in all its research activities. INRAE has a long track record of successful industry partnership. It has licensed patents and created startups and follows an open access approach for its research infrastructure.

MIN – Microbiome Innovation Network, Cambridge, UK

MIN (formerly SIG) is part of the Innovate UK KTN (Knowledge Transfer Network). With more than 150 UK-based partners from universities, research institutes and industries across the UK, MIN is a very large and strongly funded **research platform without proprietary research infrastructure**. Launched in 2019, MIN has developed a strategic roadmap with 12 priority actions to make the UK a leader in the area of microbiome research and industrialization.

- MIN **envisions** the UK to become world leader in microbiome research and innovation. MIN's **mission** is to accelerate the commercialization of microbiome-based products and services in the UK and to create a vibrant community by connecting industry and academia. MIN's **goals** include raising the visibility of, access to and investment in UK microbiome science and innovation; and fostering an environment that supports the creation of new startups, scale-up transitions and industry partnerships, and positively impacts jobs and GDP.
- As a platform organization, MIN does not have a focus on specific **key research areas** but aims to connect all kinds of microbiome researchers with industry partners and investors. MIN does, however, have a specific focus on regulatory and intellectual property aspects related to microbiome research and commercialization and pursues the aim of developing microbiome research standards.
- **Partners and services**: MIN includes around 90 universities and research institutes with over 413 research projects. It also maintains links with more than 88 industry partners. As part of KTN, MIN's key services are in area of technology transfer and investment support for development and commercialization of microbiome-related products. Many of the service offerings are related to grant applications, i.e., via Horizon Europe and support for equity investments.

Conclusion

MIN is a relatively newly founded, large research platform fully dedicated to the commercialization of microbiome research in the UK. Its "Microbiome Strategic Roadmap" includes an ambitious and comprehensive action plan on how to make the UK a leader in microbiome entrepreneurship. Its activities span a wide range, from the promotion of research collaboration to setting standards for microbiome research and creating a supportive regulatory environment for commercialization of microbiome-related products and services. MIN also offers support for financing and for grant applications.

FHU – PaCeMM – Paris Center for Microbiome Medicine, Paris, France

FHU – PaCeMM is a **local research platform** that includes hospitals, academics, and research institutions from the Greater Paris area (Ile-de-France) working on research of fecal microbiota transplantations (FMT). FHU – PaCeMM was implemented through the launch of a FHU (Federation of University Hospitals). The project was founded in 2020 and has received a 5-year label.

- FHU – PaCeMM's **vision** and **mission** is to raise awareness of and provide information about the gut microbiome as well as to increase access to FMT both in the Paris area and in France. Its goal is to leverage expertise of clinics, laboratories and research units involved in research on the intestinal microbiota and to utilize the expertise of the platform partners to carry out scientific and clinical projects.
- FHU – PaCeMM's **key research area** is science related to the intestinal microbiome and the development of new tools for medicine. More specifically, the initiative also seeks to understand the microbiome-related mechanisms involved in the pathogenesis of diseases. As an FHU, it has a specific interest in strengthening the collaboration between hospitals and universities.
- FHU – PaCeM's **partners** include 55 hospital-university teams and research organizations. FHU – PaCeMM is embedded in other national research networks such as the National Institute for Health and Medical Research (INSERM) and INRAE. FHU – PaCeMM does not has its own research infrastructure but can coordinate clinical services and reference centers, laboratories and research units, and research support. Industry collaboration and technology transfer is part of the mission of FHU – PaCeMM.

Conclusion

FHU – PaCeMM is a regional research platform fully dedicated to fecal microbiota transplantation (FMT). It has a special focus on hospital-university collaboration in the greater Paris region and mainly acts as a coordinator for research projects. FHU – PaCeMM is open for industry collaborations.

MMHP – Million Microbiomes from Humans Project, across Europe and China

MMHP is a **virtual international research platform** which aims to sequence and analyze one million microbiome samples in the coming three to five years and make the first comprehensive map of the human microbiome publicly available. MMHP was officially launched during the ICG-14 meeting in October 2019 with the goal to build the world's largest human microbiome database.

- MMHP's **vision** is to create a microbiome map of the human body and build the world's largest database of the human microbiome.
- MMHP is **aiming to sequence and analyze one million samples** from the intestine, mouth, skin, reproductive tract and other organs, focusing on feces and saliva. Other body sites for which large number of samples can be obtained will be accepted.
- MMHP's key research area is the human microbiome. Its founding **partners** from universities in China, Sweden, France, Denmark and Latvia have been joined by several other academic and private institutions around the world. MMHP offers services in the area of specific metagenomic sequencing (MGI's DNBSEQ™ platform), maintains a super computing platform and has also implemented a safe data sharing policy. Even if this hub is more of a virtual network, every research team from all over the world can submit a proposal and be part of it. Members benefit from common flagship paper publications and reduced prices for sequencing. The database is not yet active.

Founded in 2019, MMHP is a virtual international research platform fully dedicated to creating the world larges database of the human microbiome. In this regard, MMHP is developing its specific proprietary tools for sequencing and for data storage. Its partners are mainly from Europe and China.

Conclusion

CMIT – Center for Microbiome, Informatics and Therapeutics; Boston, MA, USA

CMIT is a microbiome **research hub** within the Massachusetts Institute of Technology (MIT). It offers a clinical collaboration program that helps facilitate clinical research with physician researchers in New England, USA. CMIT has a focus on inflammatory bowel disease and is to develop therapeutics against microbiome-related diseases. Similarly to MMHP, CMIT started several initiatives to identify and conserve microbiome samples and become a reference center for microbiome data. CMIT was founded in 2014 through a $25 million donation to MIT.

- CMIT's **vision** is to promote education and collaborative investigations among the next generation of scientists and doctors who are passionate about the potential of microbiome research and therapeutics. CMIT's goal is to become a **center of reference** for microbiome research and data storage.
- The **research focus** is on inflammation and autoimmune diseases. CMIT's flagship project is about tracking inflammatory bowel disease; patients are monitored to find better methods to diagnose patients earlier.
- Since 2014, CMIT has grown into a program of over 21 funded researchers and 13 clinical collaborators across multiple disciplines. CMIT has an established clinical study award for PhD and MD students. Its website offers broad information on microbiome research. CMIT offers four different **services**:
  - The Global Microbiome Conservancy isolates non-industrialized populations' gut microbiomes
  - The OpenBiome is a non-profit stool bank that works together with CMIT to support translational microbiome research
  - CMIT's facility Microbial Omics Core prepares samples from clinical collaborations and research projects and generates data
  - The Broad Institute-OpenBiome Microbiome Library is a collection of more than 7,000 strains of bacteria isolated from the gut microbiome of healthy adults. Scientists can request bacterial strains

Conclusion

Founded in 2014, CMIT is a Boston-based regional research hub with its own proprietary digital research. It has a clearly defined research focus on certain defined inflammation and autoimmune diseases. CMIT's ambition is to become global center of reference. CMIT's website represents a platform to learn about the microbiome and raise awareness for the topic. Several videos, including TED talks from microbiome research pioneers and books about the microbiome, are recommended. Students have the chance to join interdisciplinary programs or the Microbiome Club, a student-led community education and outreach arm for microbiome enthusiasts. CMIT offers PhD and MD students a clinical study award for outstanding microbiome research studies.

APC – The Alimentary Pharmabiotic Centre Microbiome Ireland, Cork, Ireland

APC was founded in 2003 in Ireland as “The Alimentary Pharmabiotic Centre” and is of the earliest and most established microbiome hubs globally with around 300 scientists and support staff in the community. The APC is based in University College Cork and the Teagasc Food Research Centre also based in Cork as well as several other partners in Ireland. Having placed greater focus on the microbiome, APC was rebranded in 2018 to APC Microbiome Ireland.

- APC **envisions** being a world leader, an agent of change that on its mission with excellence and impact. The ambitious goals include **linking Irish science with industry and society through research**, education and public engagement.
- Since its origins, APC has mainly operated in the area of gastrointestinal research but has also expanded into other microbiomes and anatomical sites to work with the food, pharma, diagnostics and veterinary industry sectors.
- Several platform technologies such as next-gen sequencing and quadrupole time-of-flight (QTOF) mass spectrometry analysis support all the research teams in APC as a non-commercial **scientific service**.
- **Collaborations with other academic institutes and industry** have been a strong support since the beginning and long-term relationships remain today. APC is funded by Science Foundation Ireland (SFI) through its Research Centres programme.

Conclusion

As probably the oldest microbiome initiative globally, APC is well-known and well-established in the international microbiome field. The initiative has enjoyed robust collaborations with industry and secured funding from the beginning from a range of national, international and industry sources. Four spin-out companies have been created from APC in the area of the microbiome: Atlantia Clinical Trials, 4D Pharma Cork, Artugen Therapeutics, and Seqbiome. Another UCC spin-out company, PrecisionBiotics Ltd, was founded by APC scientists in 1999 and was sold to Novozymes in 2020.

CRC – Collaborative Research Center 1182 "Origin and Function of Metaorganisms", Kiel, Germany

CRC is an interdisciplinary network of six universities (Kiel University; the GEOMAR Helmholtz-Zentrum für Ozeanforschung Kiel; the Max-Planck-Institut für Evolutionsbiologie Plön; the Heinrich-Heine-Universität Düsseldorf; the Leibniz Institute for Science and Mathematics Education; and the Muthesius University of Fine Arts and Design). It is supported by the **German Research Foundation** (DFG) and deals with the question of how plants and animals including humans form functional units (metaorganisms) together with highly specific communities of microbes.

- The CRC's **vision** is to understand how microbial communities create synergies with their hosts across several types of organisms. The **mission** is to decipher evolutionary dynamics of metaorganisms and the molecular interactions to define common and distinct valid principles of host-microbe relationships for all living creatures.
- Research topics extend across several organisms such as the human, fungi and wheat, Caenorhabditis elegans, and several other (meta)organisms. The **fields of research** are evolution and ecology, recognition and communication, and function and life history.
- Thanks to funding from DFG, six universities built a strong **collaboration** and were able to build an interdisciplinary research cluster which has worked closely together for 12 years. Typically, the CRC has no industry collaboration as a DFG-funded research hub.
- Three core projects are included in the CRC as **service centers** and hubs for interaction:
  - Microorganism culture and single cell analysis
  - Next generation sequencing and proteomics applications for studying metaorganisms
  - Data management and integrated analyses
  - These core projects aim to create substantial scientific value

Conclusion

CRC represents a purely academic research hub consisting solely of universities focusing on fundamental research in the space of microbiome interactions with metaorganisms. It is funded for 12 years and created infrastructure in the form of research projects that engage with all other research groups to build standards and learn from each other.

EMC – Euregional Microbiome Center, across Netherlands, Germany, Belgium

EMC is a regional hub across a tri-national region including the Netherlands (Maastricht University, Maastricht UMC), Germany (University Hospital of RWTH Aachen), Belgium (University of Liège). It was created recently in 2021.

- The **vision** and **mission** of EMC are to initiate and reinforce collaborations across traditional scientific and clinical disciplines to foster scientific excellence, advance microbiome research and create an active microbiome research community across borders.
- EMC **research areas** are specifically focused on the human microbiome with an emphasis on host-microbiome-diet interactions in early life, antimicrobial resistance, and the identification of unknown community members in the microbiome and discovery of microbial markers for precision medicine.
- Four universities/university medical centers from three different countries work together. Research groups collaborate and perform different experiments in different locations to **benefit from the local expertise and infrastructure** of the groups. However, a joint infrastructure is not envisioned. Since it was only recently founded there are no collaborations beyond the hub, except for research projects organized by the individual PIs. However, EMC is part of several research consortia and networks with the aim of becoming more visible and establish the hub in the microbiome space.

Conclusion

EMC represents a tri-national hub with a focus on the microbiome in humans' early life. In 2021 the hub was founded, and the first kick-off symposium took place. For now, there is no common funding.

NCCR – Swiss National Centre of Competence in Research Microbiomes, across Switzerland

NCCR Microbiome brings together an interdisciplinary consortium of 23 research groups from six institutions across Switzerland. The initiative combines the expertise of computational and experimental microbiome research with clinical microbiome studies to understand and devise strategies to intervene and restore imbalanced microbiomes. Research institutions included in the NCCR are the University of Lausanne (leading house), ETH Zurich (co-leading house), EPF Lausanne, the University of Zurich, the University of Bern, and Lausanne University Hospital (CHUV). The research hub was launched in 2020 and is funded by the Swiss National Science Foundation (SNF).

- NCCR is a young hub with the **vision** firstly to establish a tight-knit community of scientists working on all aspects of the microbiome across Switzerland. The newly formed network seeks to understand how microbiomes are formed, function and evolve and develop methods and bioinformatic tools to support this aim. In later phases, the NCCR aims to develop intervention strategies for medical and environmental applications.
- NCCR shares computational, modeling, engineering and synthetic approaches to understand the unifying principles of microbiome functioning through six **interlinked work packages**, including human, animal, plant, environmental and synthetic and engineered microbiomes.
- NCCR has currently no joint research projects with the industry, however, it has established contact with several companies and is seeking to establish collaborations in the future. In addition, the initiative fosters the development of new technologies and industrial applications from their work packages to attract collaborations with third parties and potentially create startups. Due to its recent foundation, no infrastructure is yet in place.

Conclusion

NCCR is a recently founded network of research institutes across Switzerland that pursues the aim of building a scientific microbiome community in Switzerland. Through a variety of research topics, the microbiome is well covered.

How initiatives have been created

The different initiatives selected for this report were created or initiated in various ways. Examples include:

- **Building a new organization** or research entity with a focus on the microbiome as part of an already existing large research organization. For example, microbiome research is part of Microbiology and Food Chain, one of 14 research divisions of the French INRAE.

- **Shifting the focus** of an existing research organization such as the Irish Alimentary Research Center towards microbiome research as the APC Microbiome.

- **Applying to national research coordination programs** for special research funding of a new microbiome initiative. Often such initiatives are for a limited period. Examples include NCCR in Switzerland and CRC 1182 in Germany.

- Creating a microbiome initiative **within an organization with a broader focus** on tech transfer and investments such as the MIN, which is under the umbrella of the British Knowledge Transformation Network (KTN).

- Creating a microbiome initiative as a part of one or several existing academic institutions with **geographic proximity** such as the Boston-based CMIT, or the Paris-based FHU – PaCMM.

- Creating a **regional or global network** of institutions with a common goal to develop a technology or answer a specific scientific question without a pre-existing institutional framework or regional connection. An example within such a category would be MMHP.

- Finally, there are **startup-like initiatives** where group researchers with an **entrepreneurial mindset** come together to start an initiative for research collaboration without any pre-existing institutional framework of funding. The tri-national EMC can be considered a startup-like initiative.

Taking into consideration the already existing institutionalized collaboration between regions and different universities under the umbrella of Medicon Valley, a future initiative focusing on the microbiome might come close to the CRC, the FHU – PaCMM or possibly the EMC.

Detailed analysis of four selected microbiome initiatives

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APC – The Alimentary Pharmabiotic Centre Microbiome Ireland

Initiative	Locations	Partners	Founded	Type	Range
APC	Cork & Teagasc, Ireland	Academia Industry	2003	Hub	National

Interviewee

Brendan Curran, PhD, General Manager (Interim), former Manager of Business Development, IP commercialization and licensing.

Governance

There are around 250 employees and students in the APC community led by 22 PIs, a management team of 15 people, 60 postdocs 70 PhD students and several technicians, research nurses, research assistants and master students. Currently, APC has 20 industry partners.

It has established several internal teams with important functions such as research, community management, operations management, education, grants, and program management to attract philanthropy funding.

APC is structured as a **matrix organization**. It has four broader vertical areas of academic pursuit (e.g. Brain-Gut-Microbiota axis) which are intersected by several horizontal technical platforms that work together with all research groups.

Funding

APC is involved in several strategic partnerships which provide funding. The main funding source is Science Foundation Ireland. The funding model requires that every EUR 1 given by the foundation must be matched by EUR 1 from industry and another EUR 1 from other non-exchequer sources such as Horizon Europe, where APC plays a role in coordination of project but also as a partner where others coordinate the projects. EU funding applications such as the Marie Curie Fund, are orchestrated by a central support team. An EU grants manager is fully dedicated to securing research funds. A business development manager is dedicated to securing industry partners and industry funding and large amounts of funding come from industry bound to specific collaborative projects with individual companies.

Services

The support technology platforms in the matrix organization provide access to key facilities and technologies including Next-Gen sequencing, Bioinformatics, Flow Cytometry, Germ -Free and pre-clinical models. Where access to platforms is not already budgeted under the core SFI Centre grant, usage is billed through an internal transfer system to keep administration work to a minimum.

While the APC is not a commercial service provider for industry, the platforms are a magnet to industry in terms of catalyzing research collaboration with APC.

Internal collaboration

APC incentivizes internal collaborations through various mechanisms. For example an executive team meeting among research leaders takes place weekly to provide scientific updates and naturally facilitate collaborations. Further, there are fortnightly research seminars to keep the whole community up to date on research across all APC groups. Further, an annual symposium brings the scientists together and a postdoc association supports postdocs in their scientific career.

It is common for PhD students to have two supervisors, e.g., one supervisor from UCC and one from Teagasc. Sharing PhD students brings PIs together and leads to new collaborations. There are plans to create a new strategy for even more collaboration between research groups and attract talent. This will include a dedicated PhD program specifically tailored to microbiome research. Organized social activities bring people together that can lead to further collaborations.

Industry collaboration

That industrial collaboration has been important for APC since the beginning is reflected in the long-term relationships they maintain with several industrial players. APC manages the whole process from the initial meeting to the end of the project. A full-time business developer works on seeking new partners and strengthening existing partnerships. Business development which is a collective endeavor includes attending important conferences and presenting APC as well as actively reaching out to companies. IP and out-licensing are the primary responsibility of UCC's technology transfer office with active assistance of the business development manager. APC is generally a magnet for industry because of its broad capability, international profile and reputation. It is not rare that collaborations start with a single focus on a research project but are soon extended and expanded into related fields due to APC's broad capabilities. Thanks to its range of functions and close relationship with its parent University, APC benefits from faster and more flexible administration when starting a collaboration.

USP

APC combines critical mass at the clinical medicine, basic science and food technology interface with sustained research excellence that makes a real impact. It has a highly regarded outreach program and a willingness and capability to work with industry of all sizes and types.

Key value proposition

APC accelerates the transfer of technology for research to industry and supports research groups through a grant office. APC is recognized as an important part of the Irish Life Sciences community and as a driver for the creation of spin-offs and attraction of foreign direct investment.

Public outreach

APC has a strong programme for education and public engagement. The initiative promotes programs at different levels, from schoolchildren and the general public to patients and those with higher degrees. At elementary school level, APC offers science art projects and training courses for primary school teachers. There are several activities and programs for secondary schools, as well as third and fourth-level education. In 2018, APC launched the first "World Microbiome Day". APC also provides information and book recommendations. Besides providing general information to the public, the initiative also offers information for patients and details of upcoming scientific conferences.

CRC - Collaborative Research Center 1182 "Origin and Function of Metaorganisms"

Initiative	Locations	Partners	Founded	Type	Range
CRC	Kiel, Germany	Academia	2016	Hub	Regional

Interviewee

Thomas Bosch, PhD, Dr. h.c., Speaker and Founder of CRC, Professor at Zoological Institute, Kiel University.

Governance

The speaker and the Steering Committee lead the CRC and are required to make decisions jointly. The CRC is supported by an **advisory board** of five international pioneers in their field.

Funding

The CRC was created by **special funding from the German Research Foundation (DFG)** for a limited period of 12 years with the **intention to build long-lasting regional infrastructure**. The project has a flexible funding model. In the four years the CRC receives EUR 12 million in total and is very attractive for the region. For further funding, the hub will have to apply again and demonstrate its achievements over the years. In addition, PIs have their own funding.

Services

Three **core projects provide services** across all other research groups. The three projects include microorganism culturing and analysis, sequencing and proteomics, and data management and integrated analysis.

Internal collaboration

Being part of a CRC has several advantages, including prestige, access to flexible funding and participation in flagship publications in high-impact journals. There are 20 research groups working on 12 interdisciplinary research projects. **Every project must be led by two PIs** and has two subprojects, with each PI being responsible for one subproject. Research groups with different backgrounds work and publish together, something that might never have happened without the initiative of the CRC.

Industry collaboration

Since the CRC is a publicly funded organization focusing on fundamental research, collaborations with industry would do more harm than benefit.

USP

CRC is the only research center worldwide that investigates microorganisms in an interdisciplinary approach **across all organisms**.

Key value proposition

The CRC explores an as yet under-investigated scientific topic that will be of importance in future according to leading experts.

Public outreach

Public outreach is a big topic for the CRC. One condition for building CRC is educational outreach, and CRC works together with a pedagogical institute. Furthermore, CRC created a brand name with “Metaorganisms”. According to the interview partner, “*Public outreach is scientific outreach. It is not done with a couple of press releases*”. CRC’s public outreach follows three pillars:

I. **Inclusion and diversity**. Different demographics, different backgrounds and academic and non-academic stakeholders must be included. Cutting-edge science needs to be explained easily to the public

II. **Keeping interest high**. Experts from various fields are interviewed in a series to keep attention high.

III. **Scientific communication**. CRC collaborates with an art college for scientific communication. This partnership led to the creation of a spin-off company.

Attraction of talents

The CRC has a **talent management program** for PhD students, postdocs, and PIs to support their career development. An integrated individual coaching program for their personal development is in place with a professional coach. In addition, CRC created a mentoring program where young scientists can be mentored by selected professors.

CRC **awards young scientists** and provides them with the possibility to develop their own independent research projects, gain new scientific input and strengthen the network. Further, CRC supports outstanding female postdocs with an additional fund. CRC sponsors a long-term research stay for a scientist awarded a fellowship to do research in the laboratories of CRC.

EMC - Euregional Microbiome Center

Initiative	Locations	Partners	Founded	Type	Range
EMC	Netherlands, Belgium, Germany	Academia Industry (planned)	2021	Hub	Tri-national/ Regional

Interviewee

John Penders, PhD, Director and Founder, Associate Professor at University of Maastricht.

Governance

EMC is not a legal entity but a **virtual collaboration network** with up to 50 PhD students and postdocs. It started with individual organized collaborations. As collaborations expanded and common research fields with surrounding universities developed, the EMC hub grew organically. The **entrepreneurial spirit and startup-like mindset** was necessary to build such an initiative without any additional funding or support.

PIs from the labs are also directors on the board. Monthly there is a meeting of the board. Having launched during the COVID pandemic in 2021, EMC started virtually with webinars where PhDs and postdocs presented their work. A future goal is to attend each other's lab meetings and get dedicated resources for research administration and business development support.

Funding

At the moment, funding comes from each PI. Due to its tri-national nature, EMC is less likely to win national grants. Therefore, EMC plans to apply for EU grants and joint funding for joint PhDs, which conduct transdisciplinary research and move around the labs in different locations.

Services

There is no physical infrastructure in place. However, the hubs benefit from the local expertise of each research group. **PhD students move across labs** to learn animal handling, sequencing and data analysis from specialists in different locations.

Internal collaboration

Since **collaborations were pre-existing before EMC**, it is very natural that research groups work together across fields. They already had shared PhD students with a main responsible PI from one university but visited culture of visiting other labs to gain more experience.

Industry collaboration

Industry collaboration is not a primary interest yet. There are discussions with industry partners, and individual research groups have research projects beyond the hub. The establishment of the microbiome community remains the first priority for this fledgling hub.

USP

EMC focuses on early life microbiome and antimicrobial resistance in **three different countries**, with different expertise in animal models or birth cohorts and the use of antibiotics in different hospitals.

Key value proposition

EMC offers scientific research spanning three different – but geographically close – countries and different scientific expertise. Collaboration allows the initiative to apply for larger international funding.

Public outreach

EMC is planning to get a research coordinator and administrative support. It also intends to develop its website further and create a communication strategy for its own publicity.

Country differences

Legal agreements between faculties from different universities and countries can be a challenge. Cultural differences are seen in hierarchies and rules for PhDs. However, this should be solved by creating an official multinational PhD program in the future, funded by EU grants or joint PhD grants.

NCCR Microbiomes - National Centre of Competence in Research Microbiomes

Initiative	Locations	Partners	Founded	Type	Range
NCCR	Across the whole of Switzerland	Academia Industry (planned)	2020	Hybrid	National

Interviewee

Eavan Dorcey, PhD, Manager for Organization, Finances, Education, Equal Opportunities, Communication and Public Outreach.

Robin Tecon, PhD, Manager for Scientific Program, Technology Transfer and Strategy Development of NCCR.

Governance

The University of Lausanne and ETH Zurich are the leading universities in NCCR. Around 100 people are involved overall, including 23 PIs, the equivalent of two full-time equivalent managers (three from July 2022), various PhD students, postdocs, bioinformaticians and technicians. A steering committee and a scientific advisory board are part of the **complex governance**. All PIs act together in a consortium and need to agree on decisions.

Funding

NCCR is **mandated by the state** with a specific focus on research, technology transfer, promotion of equal opportunities, and outreach. The Swiss National Science Foundation granted approximately CHF 17 million over a period of four years and, if approved, it will be possible to prolong funding up to two times to cover 12 years overall. NCCR enjoys large flexibility within the budget received. In addition, host universities contribute around CHF 15 million.

Services

There is no specific infrastructure. Efforts are underway in regard to standardization of techniques, protocols and tools wherever possible. **Resources are available for everyone** and stored in a “wiki” source. High-performance computing clusters are used from the universities where the research groups are affiliated.

NCCR management supports the research groups of the Consortium with regards to technology transfer, but ultimately relies on the technology transfer offices of the partner universities concerned.

Internal collaboration

Due to the involvement of different research fields, PIs without a history of working together started to collaborate. This hub was **launched in 2020 during the COVID pandemic** and **started fully virtually** without any personal meetings. Online meetings helped to build a community and keep all stakeholders up to date. However, the benefits of personal events and socializing are clear. Regular meetings now take place and are hosted alternately in Lausanne and Zurich.

A **co-mentoring** program is in place, which means every PhD student and postdoc can find a second mentor within NCCR, who does not need to be a scientific advisor. Mentoring can also be for career development, for example. Management supports students in finding the right mentor.

Industry collaboration

With the exception of pre-existing collaborations with individual groups there are no collaborations with industry yet. Even in the early phase of existence, NCCR has been approached by industry stakeholders and sees high potential for collaboration in the future. NCCR supports spin-offs, including where they are already affiliated to incubators or accelerators.

USP

NCCR has the ambition to increase public awareness for the importance of the microbiome through investigation across systems and organisms to find common and distinct principles.

Key value proposition

NCCR enables interdisciplinary research, especially in synthetic and computational biology, that has an impact on society and knowledge transfer. PIs benefit from public outreach and common publications in high-impact journals. Young researchers benefit early in their careers from the tight microbiome network.

Summary

Initiative	Description
APC Ireland	**Key features** - Established hub with roots in gastrointestinal and agricultural research in Ireland - Matrix organization with four research areas - **Shared scientific service** with an internal booking system - **Shared PhD student program** to foster collaborations between universities **Success factors** - Solid financial support through governmental funding - Strong backing by Irish investment promotion - **Grant/fund team** focusing on identifying and applying for grants/funds - Strong industry focus with business development and technology transfer team
CRC Germany	**Key features** - International **advisory board** - Core team that provides **scientific services** for all research groups - **Two PIs co-leading each project** to ensure interdisciplinary research - Heavy investment in **public outreach** to raise interest and educate the public - **Talent management program** to support the career development of young scientists **Success factors** - Financially backed by the German Research Foundation (DFG) - Strong **public outreach** and **communication program** - Interdisciplinary research as a condition for a research project - Comparability and standardization of data from various organisms through scientific service - Support of young scientists with programs and awards

Initiative	Description
EMC Netherlands, Germany, Belgium	**Key features** - Initial collaborations that grew in a **startup-like mindset** - Expansion into a **virtual collaboration network** - **Shared PhD students** moving across labs in different countries **Success factors** - Clear focus on a scientific **niche** - Start-up mentality - Strong focus on knowledge and data sharing
NCCR Switzerland	**Key features** - Financially backed by the Swiss National Science Foundation as part of the Swiss National Centre of Competence in Research Program - Established and tested governance model with management and scientific team - Strong focus on interregional collaboration with teams in different linguistic regions of Switzerland **Success factors** - Solid funding with milestones for extension; limited to a maximum of 12 years - **Dedicated management team** with a focus on public outreach and scientific program - **Co-mentoring program** to support PhD students in scientific matters but also personal development - Scientific focus on synthetic and computational biology

Summary of interviews with Medicon Valley stakeholders

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Summary

The following Medicon Valley stakeholders were interviewed:

- **Dina Petranovic Nielsen**; PhD; eMBA; Associate Professor; Chalmers University of Technology; Chief Partnership Officer and Chief Scientific Officer; The Novo Nordisk Foundation Center for Biosustainability; Technical University of Denmark
- **Kristin Wannerberger**; PhD; Global Director R&D Alliance Management; Ferring Pharmaceuticals; St. Prex; Switzerland
- **Mani Arumugam**; PhD; Associate Professor and Group Leader; Novo Nordisk Foundation Center for Basic Metabolic Research; University of Copenhagen
- **Gianfranco Grompone**; PhD; Chief Scientific Officer; BioGaia AB; Stockholm; Sweden
- **Åsa Håkansson**; PhD; Associate Professor and Senior Lecturer; Department of Food Technology, Engineering and Nutrition; Lund University; Sweden
- **Adam Baker**; PhD; Head of Discovery; Human Health & Nutrition Division; Christian Hansen; Copenhagen; Denmark

Overview

Interviewees agreed that the Medicon Valley cluster is well-positioned to become a research hub for microbiome topics, given the **ongoing research activities in the microbiome field** in the region and the number of local companies with activities related to microbiome research.

The consensus was that a microbiome initiative should focus primarily on promoting **research collaboration**. In addition, most of the respondents agreed that the initiative should also provide **centralized research infrastructure**. The proximity to three universities and several clinics makes it an attractive prospect for becoming a research hub that makes use of the local distributed strengths from several companies in the field.

Mission statement (vision/mission/aims)

According to interviewees, there is significant microbiome research capacity existing in the Medicon Valley region. However, there is a **lack of coordination** between the research groups and between industry and academia. The **vision** for a future microbiome initiative should therefore be to **create a regional research community** which leverages existing research capacities. However, most interviewees had no clear view on the potential **mission** beyond supporting collaborative research. They also declined to opine on whether this hub should focus on **a specific area of research** or remain **broad in its research approach**. One interviewee specifically highlighted the importance of developing a brand in parallel with a mission statement in order to become more attractive to top researchers and investments. Further, it was suggested that the hub should focus on translational research to close the gap between basic research and marketed applications.

While the interviewees agreed that one **goal** should be to **strengthen bi-national collaboration** between the Skåne and the Copenhagen areas, they also acknowledged the associated challenges, including the administrative complexity of different academic systems. Defining a clear mission statement was seen as an essential step to overcome these hurdles.

USP, branding, and public outreach

One interviewee had a clear view on the importance of **creating a strong brand** alongside a clearly defined mission statement. That interview saw branding efforts as essential to attract talents and to stand out in the scientific field, which is already crowed by many microbiome initiatives.

Other interview partners mentioned specific regional USPs which could be an attractive asset to a microbiome hub: Denmark and Sweden both have a **national patient registry**, a **valuable asset for clinical research**, given that it provides retrospective and prospective patient data from two different countries in one region. Researchers can, for instance, use this data to investigate the impact of antibiotics usage on patients' microbiome and the course of disease or treatment prediction. Another USP is that the Medicon Valley region is highly attractive for researchers and their families as a **great place to live**.

Public outreach was mentioned as vital in order to obtain support for the initiative across regions. One interviewee advocated the educational programs for non-scientists as a way to promote the initiative to industry and the larger public. Public outreach should aim at creating demand for microbiome knowledge. The societal need must be uncovered, and the importance of microbiome work demonstrated. The two national governments need to recognize the importance and added value for the region of supporting the creation of a hub.

Value propositions

According to interviewees, while there is a microbiome network with twice-yearly meetings hosted by Medicon Valley Alliance for academic and industry stakeholders in Medicon Valley, there is also clear interest in a more structured organization to push microbiome research in the Medicon Valley. There is agreement among the interviewees that the **value proposition** of a microbiome initiative should include **physical research infrastructure in addition to other services**.

Interviewees claimed that proprietary **research infrastructure** – with resources and devices owned and **managed by the hub – is essential for the success of an initiative**. This must be made available to all participating research groups through a **free, or at least low-fee**, access model.

Although the need for infrastructure is clear, there is no common view on the type of **infrastructure, resources and devices** needed. Some interviewees mentioned the lack of affordable wet lab space while others see gaps in data analytic services.

One interviewee suggested starting by **mapping the existing equipment** in the microbiome network and identifying who is ready to share their expertise and their equipment.

Other interviewees suggested that research infrastructure owned by the hub should also be made available to users outside of the microbiome hub when not being used at full capacity by members.

In addition, access to **scientific consulting services** for experiment planning and data analytics should be offered.

At the same time, interviewees are aware of the challenges regarding the location of the research infrastructure given the bi-national nature of the initiative.

Funding

Interviewees mentioned different types of funding opportunities: government, industry, philanthropy and academia.

Possible funding opportunities from **government** are found at several levels:

- EU-wide
- Nordic region
- National (Denmark and Sweden)
- Regional

Industry can be a **supplemental funding source** but will not carry the costs alone. Industry must be involved from the beginning and needs to see the purpose and the benefits. Creating a “fear of missing out” among industry partners is an effective driver to generate funding. Ideally, industry funding should be tied to interregional or academic collaboration.

Philanthropy can be a strong source of funding if the requirements are fulfilled. The mission statement must be **aligned with the values** of the philanthropic institutes, e.g., the Novo Nordisk Foundation Center. There should be a greater focus on philanthropy.

Academia cannot always participate with financial funding. However, the academic community owns property, devices and resources and offers their services. It is conceivable that universities could **allocate physical infrastructure** such as facilities as well as staff with their expertise.

Collaborations

Interviewees agree that incentivizing research collaborations is challenging but also identified various possibilities to achieve this:

- Create a **bi-national fund** that **includes collaboration between different universities** as an eligibility requirement
- **Support research groups in accessing large funds** (e.g., Marie Curie Fund), which are easier to get with international collaborations
- **Drive organized coordination of research collaborations** to give an overview of which researcher is working in which field and who is collaborating with whom
- **Creating rotational PhD program** for "shared PhD students" who are moving from one lab to another through different universities
- **Engage in mutual teaching** by lecturers at other universities

Industry collaboration

Collaboration with industry was viewed as important by the interviewees. Some suggested inviting industry stakeholders from the beginning to co-design the future microbiome hub. One interviewee mentioned the importance of long-term research collaboration. Collaboration with universities and **hospitals to conduct clinical trials** is particularly interesting for industry stakeholders

The importance of a **centralized technology transfer office**, which would help to reduce the administrative burdens of negotiating IP transfer and research collaboration, was mentioned as an important service that could be provided by the hub.

One interviewee highlighted the openness of the industry to **fund PhD students**. The microbiome hub could take on a role coordinating such a microbiome PhD program.

Key focus areas for research

In parallel to defining the mission statement, the initiative must decide on the area of focus. While the interviewees were not clear on the detailed vision or mission of a future hub, many of them flagged the importance of focusing on **applied and translational research rather than basic research**. According to interview partners, Medicon Valley has strong capacities in clinical research and commercialization. Focusing on commercial aspects and product development for microbiome applications could be an interesting opportunity for the microbiome initiative. Particularly interesting research focus areas were as follows:

- The **maternal microbiome** is a field that is not well studied and all related fields to pregnancy and the unborn are seen as important
- **Environmental factors** affect humans, including the unborn, and could be linked to different types of diseases such as autism
- **Sustainable food and targeted food** could be used as personalized medicine
- One of the most interesting and unknown fields that was mentioned is research with **bacteriophages**. There are not many research groups focusing on studying bacteriophages and how to use them for human health. This presents a blind spot in the regulatory framework

Organization

The current setup provided by Medicon Valley Alliance to manage the existing microbiome network is considered insufficient to support a strong microbiome initiative. Interviewees agree that for the successful launch of a microbiome hub, an administrative organization with an executive management team is required. Where this team could be located was not discussed in the interviews.

Challenges

The biggest challenges for the future research hub mentioned by the interviewees relate to **financing**, i.e., for developing and building the hub, as well as institutional and personal **resistance to collaboration**. **Attracting and retaining talent** was also picked up as a hurdle, especially in data analytics. Finding qualified and ambitious staff with an open, collaborative mindset and the “can-do” mentality to work for the microbiome initiative will also be challenging. Another difficult decision will be selecting the **location for the research infrastructure**.

Recommendations

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Key success factors

The MSP partners and stakeholders have clearly articulated their interest in capitalizing on the work performed by the MSP through a follow-up initiative. **Taking into account the insights from the analysis of the different hubs** and interviews with the key stakeholders, the following typical organizational key elements and **key success factors** for a microbiome initiative were identified:

Holistic mission statement

All initiatives have a defined mission statement to advance science, society or economy.

APC is working to link Irish science with industry and society, whereas CRC's main focus is purely on fundamental research. Both EMC and NCCR pursue the aim of creating a scientific microbiome community and fostering collaborations.

Future-proof research focus

Traditionally, initiatives can be characterized by whether:

- *Their focus lies on basic or applied and translational research*
- *Their goal is to conduct broad research or become a specialist in a specific area*

APC has a main focus in gastrointestinal research but expanded its research areas to include food, pharma, diagnostics and veterinary research. Together with industry, APC is working on the comprehension and application of products. Similarly, EMC is specialized in human-focused areas such as the early life microbiome and antimicrobial resistance. In contrary, CRC and NCCR have a much wider focus and study microbiota across different organisms.

Value proposition to support research and industry collaboration

A strong value proposition adds value for all stakeholders and creates a "fear of missing out" on such an initiative.

APC maintains a grant office to support researchers in identifying and winning funding. Industry also benefits from fast technology transfers due to APC's own independent office. CRC conducts cutting-edge research with a broad subject interest to uncover future-proof research areas. EMC demonstrates how effective collaborations can be achieved across national borders, while NCCR has already demonstrated how virtual collaboration can serve as a good start and result in high-impact journal publication.

Dedicated organizational/governance model

Almost every initiative has a dedicated management team. Additional external support of experts is beneficial to accelerate success.

With the exception of EMC, all of the hubs have a dedicated management team and an international scientific advisory board comprising members from academia and industry. Since EMC launched in 2021, it is a relatively new hub with fewer members. Every PI is part of the board of directors and there are plans to arrange additional administrative support. NCCR has a strong decentralized interregional governance model.

Branding, USP and public outreach

Successful initiatives have successful brands backed up by their USP. A well-defined communication strategy and public outreach is crucial for the creation of a successful brand.

APC has a strong communication strategy with education programs for children and teachers at primary school level as well as the general public and university students. CRC's founder is also the speaker of the hub and places a strong focus on external and internal communication. CRC even works with a local university of arts for a scientific communication program. EMC and NCCR are planning to establish a communication strategy.

Recommendations

The above-mentioned success factors informed the recommendations set out below for the development of a microbiome hub in Medicon Valley.

Mission statement

Based on the existing mapping of the microbiome ecosystem in Medicon Valley, it is recommended to **analyze the foci of the different research groups**. The same exercise should also be conducted with the industrial partners, startups and philanthropic stakeholders. This will allow overlaps and common research interests to be identified. Once one or several research foci have been identified, a mission statement (vision/mission/goals) can be formulated. A holistic mission statement should include elements such as **scientific, technical or socioeconomic goals** (if any). It should answer the questions of "**Why is this initiative necessary and relevant**" and should be the foundation for building a solid culture of collaboration among stakeholders.

Future-proof research focus

In parallel with the development of the mission statement, one or several **future-proof research foci with potential for interdisciplinary collaboration** should be identified. It is recommended to set up a scientific research board consisting of key stakeholders and external experts. **Inviting stakeholders from academia, industry, startups and philanthropy from the beginning** enables a future outlook with different perspectives. The goal should be to develop attractive research programs which trigger a "fear of missing out" among stakeholders. To find a common research focus it is necessary to agree on the scope of research, and whether to pursue applied or translational research. In this case, **applied research in the field to human health or translational research** that can be tested in humans should be considered, since MV has strong capacities in clinical research and commercialization.

Based on desktop research and stakeholder interviews, possible topics for a research focus could include (not exhaustive):

- Microbiome and the relationship to **lifestyle diseases** including obesity, inflammation and allergies
- **Medicine meets food** to develop targeted food to support human health
- **Food-related** questions addressing the loss of diversity in the microbiome
- **Maternal microbiome** including changes during and after pregnancy and the effects on the newborn
- **Manipulation** of the microbiome as a targeted approach for treatment
- **Drug-microbiome interactions**; prediction of treatment response
- **Agricultural** questions addressing the fertility of soil

When evaluating future-proof key research areas, it is important to keep track of new developments in the **regulatory framework** governing microbiome-related drugs. It is recommended to work closely with a professional in that field such as the Pharmabiotic Research Institute (PRI) whose mission is to clarify, support and confirm the specific requirements for the development of microbiome-based medicinal products. This is of relevance for industrial collaboration since their focus is the commercialization of drugs.

Value proposition for a microbiome initiative

The value proposition should address collaboration between research groups and industry and is enhanced by a set of service offerings for the stakeholders. The initiative has to prove to its stakeholders that it creates as system where "the whole is more than the sum of its parts".

Action points to strengthen collaboration between research groups

Creating a culture of collaboration is a key objective of any research hub or platform. Steps to support collaboration include:

- Institutionalize knowledge sharing **meetings on a regular basis** between research groups
- Arrange **regional conferences, research days and summer schools**
- Institutionalize **personal gatherings and social events** where people get to know each other and develop a sense of community:
  - Building **communities** for PhD students and postdocs
  - Creating **awards** for young scientists
  - Launching **mentoring** programs for young academics
  - Initiating an **alumni** program
- Create an office for **grant funding application** support which will identify appropriate grants and provide support in winning them. Providers of large amounts such as **EU funding** (e.g., Marie Curie Fund) sets collaboration of several teams as an eligibility requirement. Further **international, national and regional funding** opportunities need to be explored
- **Coordinate supplementary funding** (from region, industry or other funding sources) for collaborative research that require the involvement of at least two different PIs from different universities and countries
- Develop attractive **rotation PhD programs with shared PhD students** in more than one university:
  - Three students, each from one university (Lund University, Copenhagen University, Technical University of Denmark)
  - Each student is affiliated to one university and has one supervisor lead at the same university and two further co-supervisors from the two other universities
  - All the supervisors are part of the PhD committee of the PhD student
  - Funding can be divided between all three supervisors
  - This promotes interdisciplinary research and breaks down barriers across universities and countries
  - The Danish Data Science Academy and the Neuroscience Academy Denmark have something similar in place with a lab rotation program in Denmark

Action points to strengthen collaboration between academia and industry

Involving industry in the planning of a microbiome hub is essential for its success. The following action points were identified:

- Institutionalize **involvement of industry stakeholders** for identification of research foci and individual research projects
- Create a centralized **business development and technology transfer office** (with antennas in different locations) to facilitate promotion of the hub on international conferences, commercialization of technology and active outreach to companies. Services provided to the stakeholder should also include negotiations of IP transfer and drafting of contract templates
- Develop an **industrially funded PhD program** with the different universities. Industry partners create the opportunity for PhD students from different universities to work in an industrial and academic research environment for one project. University PIs and industry group leaders have supervising roles and are part of the PhD committee. Industry PhD students from different universities can be **grouped together in one PhD program** to create their own dynamic group and establish further touch points between the different universities
- Identify how a collaborative platform would benefit industry. Industry can share or **rent lab space or equipment that is underused**. This might be limited to a specific purpose, e.g., only for shared research projects

Services: Providing essential research infrastructure

Physical infrastructure and cutting-edge equipment are very expensive. A system which enables **shared research infrastructure**, either managed by the hub or by one of the universities, is an important value proposition for the stakeholders of a microbiome hub.

Different approaches are possible:

- **Mapping of existing equipment** belonging to research groups that are willing to share their equipment. **Define a model** of how to share the equipment
- Setting up a **physical location** in Copenhagen and Skåne with different purposes and different equipment owned and managed by the hub. Create **booking lists and an internal billings system**

To complete the offering of physical research infrastructure it is recommended to offer **scientific consulting services** for project planning, experiment planning, statistics and data analysis as well as **scientific services** for sample processing, data generation and analysis. This can be complemented by a **shared platform** with standardized protocols, resources and tools. The option of allowing industry partners to access infrastructure should also be evaluated.

Decentralized organizational/governance/funding model

Professional and **dedicated full-time resources** under the supervision of a **steering committee are essential for a fully functional microbiome hub**. Scientific advice should be provided by an international **advisory board** consisting of leading scientific experts. Finding an executive director with an entrepreneurial mindset and scientific background, leadership and communication skills as well as strong networking abilities should be on the top of the steering committee's agenda. Assuring sufficient funding at least for five years would be required to attract top management talents. Based on insights from similar projects with bi-national key stakeholders, it is recommended to work with a model where the **leadership** of the hub is supported by local "antennas" in the various key institutions and locations. Decentralizing research infrastructure and management functions between Copenhagen and Skåne might create certain inefficiencies but is central to the success of a bi-national microbiome program. This is particularly relevant when it comes to access for funding by local governmental stakeholders.

Branding, USP and public outreach

Several interview partners highlighted the importance of investing significantly in **creating a brand when planning the hub**. Branding should go along with development of a mission statement and is vital in order to create a culture of collaboration among the partners.

Having a well-defined set of USPs is important to differentiate the hub from other initiatives. The Medicon Valley area is one of the regions performing the **most clinical trials per capita in the world, and national health registers in Sweden and Denmark** are an important resource for digital medicines. USPs are essential for attracting talents and funding. USPs also helps to create connection with the private sector and support public outreach.

A clear and offensive **public outreach strategy** should be designed to make the public and politicians aware of the importance of understanding the microbiome for human health, society and the environment. **Launching a microbiome "promotional" program** via the media, schools or art institutes could help to create broad support for the Medicon Valley microbiome initiative.

Organizing events such as **seminars, conferences or a "microbiome festival"** could raise awareness for a microbiome hub. Inviting leading researchers, environmental experts or even artists would create broad interest in the topic.

Maintaining an **educational website** with YouTube videos, TED talks, interviews, book reviews and recommendations, and setting up a microbiome club for enthusiasts would help keep the interest high. Another idea would be short weekly radio program on different aspects of the microbiome's role in daily life.

Options for a microbiome initiative

Possible options on how to start the planning of a microbiome hub in Medicon Valley are briefly described in the following section.

Option 1 – Create awareness for the microbiome

Focus in a first step on the development of a comprehensive communication strategy to **familiarize the public** and the institutions with the microbiome and its relevance for human health and the environment. Once a broad public understanding about the relevance of microbiome research has been created, start planning the next steps. Public outreach through schools, media and cultural institutions should be strategically planned and professionally executed.

Option 2 – Seek external experience first

Focus first on getting **external expertise** when starting the **strategy development and implementation** of a microbiome hub in Medicon Valley. Getting advice from **internationally experienced managers** who have created similar initiatives can help avoid costly mistakes and will provide for an outside view.

Option 3 – Develop a collaboration model

Reach out to international microbiome hubs with strong brand names and a successful track record. Evaluate possibilities for collaboration or for creating a partner organization. For example, the Medicon Valley microbiome hub could become the European outpost of a US -based microbiome hub.

Option 4 – Focus on industry collaboration and translational research

Focus from the beginning on industry collaboration. **Identify companies which are interested in creating a microbiome center of excellence** or are planning to start research in this area. Evaluate whether Medicon Valley could become a hub for translational research in the microbiome field for such companies.

Crossroads

The recommendations set out above describe key components relevant for the launch of a microbiome initiative. The next step toward the launch of a microbiome platform or hub will require decisions by the relevant stakeholders regarding which path to take at the "crossroads" to the future of the initiative. Issues to be addressed include:

Academic focus vs. focus on industry collaboration

The organizational DNA of microbiome initiatives are not all the same. Some are driven by academia, others by industry collaboration. The stakeholders should decide whether they want to have a strong focus on basic research or if the initiative should focus instead on applied, translational and clinical research.

Future-proof microbiome research areas

Related to above is the discussion about which research areas will be of most interest and relevance in the future. Different options should be weighted in accordance with the decision on whether to focus on industry or academic collaboration. It might make sense to map the ongoing research projects and then decide if there are possible overlaps or synergies and if there is a potential for commercialization.

Funding

Funding is a core consideration of any future microbiome initiative. Stakeholders have to agree on the financing strategy and should commit to financial support for a period of at least four years in order to provide a solid foundation for the initiative.

International collaboration

In this area, questions are:

- Would collaboration with an existing hub outside of Medicon Valley be an option? Should the initiative focus on "homegrown" capacities and talents?
- Should the initiative actively become involved in talent attraction?

The answers to these questions will inform the collaboration strategy and next steps.

Centralized Infrastructure vs shared infrastructure

Building up shared infrastructure is costly and not all stakeholders are supportive of this idea. Stakeholders need to decide whether the microbiome initiative should remain a platform or become a fully developed hub with its own infrastructure.

Other services provided

A fundamental question in terms of services to be provided is how willing/interested stakeholders are in shared services such as technology transfer, support for grant application, academic consultancy or business development.

Step into the regulatory field

Medicon Valley should consider whether an extension of activities to include the regulatory field is an option. Being part of the development of the regulatory framework can become an interesting feature for industry to participate actively in the hub.

Collaboration for PhD programs and shared funding of such programs

In this area, questions are:

- How strong is the willingness of the academic stakeholders on collaboration and shared funding of PhD programs?
- Is the industry willing to step in with funding for such programs?

Based on the answers to these questions, decisions can be made about shared PhD programs, including their funding.

Governance model

The basic question is whether to apply a centralized or decentralized governance model. If a centralized executive team is appointed for the hub and the supervisory board, stakeholders will need to define the mandated responsibilities. Given the bi-national nature of the project, it is also important to consider stakeholder acceptance of having certain functions centralized in specific locations. On the other hand, what are the benefits of a decentralized organization? And should external experts be invited to be members of the supervisory board?

Communication, branding and public outreach

Communication, branding and outreach were highlighted of key enablers of the microbiome initiative. The question is who would take the lead on defining and implementing such a strategy. How should be the public be involved? How can politicians become interested in the topic? And should the microbiome initiative invest in branding and promotion abroad?

Closing remarks

The success of the microbiome hub will depend on creating an **organizational DNA** which supports a culture of collaboration while at the same time incentivizes creativity and competitiveness between research groups and regions. Defining the research focus and collaboration with industry and assuring funding will be the key next steps toward the successful launch of a microbiome initiative in Medicon Valley.

Glossary and websites

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Glossary and websites

MVA – Medicon Valley Alliance

https://mva.org/

Copenhagen Capacity

https://www.copcap.com/

Invest in Skåne

https://investinskane.com/en

MSP – Microbiome Signature Project

https://mediconvalley.greatercph.com/microbiome-project

EMBL – European Molecular Biology Laboratory

https://www.embl.org/

INRAE – Institut National De La Recherche Agronomique

https://www.inrae.fr/en

MIN – Microbiome Innovation Network UK

https://ktn-uk.org/agrifood/microbiome/

FHU – PaCeMM – Paris Center for Microbiome Medicine

https://fhu-pacemm.fr/

MMHP – Million Microbiomes from Humans Project

https://db.cngb.org/mmhp/

CMIT – Center for Microbiome, Informatics and Therapeutics

https://microbiome.mit.edu/

APC – The Alimentary Pharmabiotic Centre Microbiome Ireland

https://apc.ucc.ie/

CRC – Collaborative Research Center 1182 “Origin and Function of Metaorganisms”

https://www.metaorganism-research.com/

EMC – Euregional Microbiome Center

https://www.microbiomecenter.eu/

NCCR – Swiss National Centre of Competence in Research Microbiomes

https://nccr-microbiomes.ch/

PRI – Pharmabiotic Research Institute

https://www.pharmabiotic.org/

USP – Unique selling proposition

PI – Principal investigator

Contacts and disclaimer

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Authors

André Guedel
Director
Head Site Selection Services

KPMG Zurich
M +41 79 696 75 11
aguedel@kpmg.com

Anders Stensgaard
Director

KPMG Denmark
M +45 52 150 155
astensgaard@kpmg.com

Arthur Krause, PhD
Consultant
Life Science Strategy

KPMG Switzerland
M +41 76 422 64 07
arthurkrause@kpmg.com

Partners

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