CONNECTING THE BUSINESS AND SCIENCE OF PRE AND PROBIOTICS

Microbiome research and innovation projects funded by EU

Dirk Hadrich
Health – Personalised Medicine Research and Innovation
European Commission
1. Breakthrough in 2010
2. Development and trends
3. Challenges and conclusions
4. New projects starting in 2019
MetaHIT  
2008-2012  €11M

- Broad catalogue of 3,9 M microbial genes
- Identified >19000 different functions
- Discovered 3 distinct Enterotypes
- Low diversity is less healthy
- Established IHMC

http://www.metahit.eu/

Qin et al, NATURE 2010
Arumugam et al, NATURE 2011
Dusko Ehrlich
MetaCardis
2012-2018 €12M

• Cardiometabolic diseases
• Gut microbiome data of >2000 people
• Systems biology: Gut microbes, metabolites, lifestyle, clinical data, drugs
• Intestinal barrier damages
• Low gene richness & functional pathways
• Small intestine surface area increased
• Bariatric surgery needs to be complemented

http://www.metacardis.net/
Development and trends

- Huge hidden diversity of 100 trillion bacteria
- Isolated position of metagenomics
- Maturity of analytical technologies
- Expansion of metagenomics into other areas
- Many associations discovered
- Hope on the potential of microbiome data
- Health research: Find trends in sets of big data
SYSCID
2017-2022 €14.5M

• Chronic inflam. diseases
• >60% of heritable risks are unexplained by genetics
• Systems medicine
• Western diets & increased inflammation
• Maternal microbiome & microglia

Schultze et al, Immunity 17.4.2018
Christ et al, Cell 2018
Thion et al, Cell 2018

http://www.syscid.eu/
Eat2beNICE
2017-2022 €11.1M

- Maladaptive impulsivity, compulsivity, antisocial and addictive behaviours
- Effects on brain health: dietary components, lifestyle, exercise, genetics
- Promote policy changes

http://eat2benice.eu/
## EU funded projects, budget & areas

<table>
<thead>
<tr>
<th>Period</th>
<th>Projects</th>
<th>Health</th>
<th>Non-health</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007–2013 (FP7)</td>
<td>Projects</td>
<td>40</td>
<td>51</td>
<td>91</td>
</tr>
<tr>
<td></td>
<td>€ M</td>
<td>153.4</td>
<td>89.6</td>
<td>243</td>
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<tr>
<td>2014–2017 (H2020)</td>
<td>Projects</td>
<td>73</td>
<td>52</td>
<td>125</td>
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<tr>
<td></td>
<td>€ M</td>
<td>167.2</td>
<td>87.9</td>
<td>255</td>
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<tr>
<td>2007–2017</td>
<td>Projects</td>
<td>113</td>
<td>103</td>
<td>216</td>
</tr>
<tr>
<td></td>
<td>€ M</td>
<td>320.6</td>
<td>177.5</td>
<td>498</td>
</tr>
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</table>
Some more EU projects & their focus

<table>
<thead>
<tr>
<th>EU project and ID no.</th>
<th>research area and keywords</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALLERGUT – 716718</td>
<td>allergic disorders and predisposition, environmental factors</td>
</tr>
<tr>
<td>MAARS – 261366</td>
<td>skin microbiomics, allergy, autoimmunity, atopic dermatitis and psoriasis</td>
</tr>
<tr>
<td>CURE – 767015</td>
<td>asthma, dysbiotic respiratory microbiome, phage therapy</td>
</tr>
<tr>
<td>CrUCCial – 694679</td>
<td>Crohn's disease and ulcerative colitis, index of pathogenic mechanisms</td>
</tr>
<tr>
<td>Eat2beNICE – 728018</td>
<td>maladaptive impulsivity and compulsivity and predispositions to antisocial and addictive behaviours</td>
</tr>
<tr>
<td>MultipleMS – 733161</td>
<td>multiple sclerosis, multi-omics, lifestyle, nutrition</td>
</tr>
<tr>
<td>INDIGO – 612116</td>
<td>Graves' orbitopathy, thyroid eye disease, gut-associated lymphoid tissue, biomarker discovery</td>
</tr>
<tr>
<td>HARC – 316300</td>
<td>ageing population in the Lodz region, upgrade the research potential, microbiome and immune system interactions</td>
</tr>
<tr>
<td>INNODIA – 115797</td>
<td>clinical EU infrastructure to recruit type 1 diabetes patients, living biobank, biomarker discovery</td>
</tr>
<tr>
<td>FORECEE – 634570</td>
<td>four different female cancers, environmental factors, lifestyle, hormonal and reproductive factors</td>
</tr>
<tr>
<td>GALAXY – 668031</td>
<td>alcoholic liver fibrosis, gut-liver-axis, lifestyle</td>
</tr>
<tr>
<td>EnteroBariatric – 715662</td>
<td>bariatric surgical treatment, obesity, type 2 diabetes</td>
</tr>
</tbody>
</table>
Challenges

• Big vision: modulate health via microbiome
• Mechanisms are more complex (confounders)
• Multi-omics, lifestyle, drugs, geography, ...
• Microbes compete and adapt
• Interplay with environment (microbial transmission)
• Associations → Causations
  ➢ Personalised effects
  ➢ Beneficial microbes are already present
  ➢ Early life-experiences can change brain DNA
Challenges

- Bigger prospective cohorts & easy open access
  
  ![UK Biobank data on 500,000 people paves way to precision medicine](nature)

  "UK Biobank data on 500,000 people paves way to precision medicine" - 10 October 2018

  ![EU DECLARATION OF COOPERATION](EU DECLARATION OF COOPERATION)

  "EU DECLARATION OF COOPERATION
  Towards access to at least 1 million sequenced genomes in the European Union by 2022"

- Harmonised methods to increase data comparability
  → Sample collection, storage, data processing
Conclusions: How to promote Personalised Medicine approaches in future

- Integration & Multi-disciplinarity ≠ data silos
- Involve people who hope to benefit
- Move from reactive to proactive approaches: predictive, preventive, and personalised medical solutions for the individual patient
- High impact applications for the benefit of all
Health topic 'SC1-BHC-03-2018':
"Exploiting research outcomes and application potential of the human microbiome for personalised prediction and prevention of disease"

- Existing data and new complementary data
- Functionalities, healthy conditions, resilience
- -omics, dietary data, lifestyle, ...
- Clinical tools for predicting and preventing
- € 10-15 M (total budget € 50 M)

→ Deadline 18 April 2018: 27 applications
ONCOBIOIME
2019-2023
€15M

• Gut Microbiome Signatures for 4 types of cancer ("Cancer Microbiota Atlas")
• large cohorts enrolling >9,000 cancer patients across 10 countries
• Prediction of responses (chemo- / immuno-therapies)
• Influence cancer progression (companion diagnostic tests)

MICROB-PREDICT
2019-2024 €15M

- Acute-on-chronic liver failure
- Microbiome data of >10,000 patients
- Find functional microbial traits and interactions
- Validated tools for clinical and therapeutic decisions
- Easy-to-use nanobiosensors (PoC)
- Patient Organisation involved


Jonel TREBICKA
• Autism
• Involves 600 at-risk infants
• Understand multifactorial risks
• Interactions between gut microbiome, intestinal barrier and immune response
• Integrative analytical platform using Artificial Intelligence and multi-omics
• Preventive nutritional formulation

GEMMA
2019-2023
€14,2M

autismspeaks.org
CDC estimate 2018
Alessio FASANO

International Flagship Collaboration

CINECA
EUCAN-Connect
iReceptor Plus

2019-2022/2023
3 x € 6 - 7,8 M

- Store, Share, Integrate, Standardise
- Interoperability of data from different repositories
- Bioinformatic tools to support the analysis


Thomas Keane
Fiona Brinkman
Future

• Linking different actors, multi-disciplinarity, partnerships, involving end-users & citizens
• Use multitude of data, integration & combination of real-world-data
• Standards for data comparability
• Real-life implementation of approaches
• Digital tools for faster clinical decisions
• International collaboration
• Focus on impact
Health topic 'SC1-BHC-05-2018':
"International flagship collaboration with Canada for human data storage, integration and sharing"

- Collaboration in Europe and Canada for repositories to store and share "omics" data
- Integrate and standardise data deposition and exchange procedures for better data reuse
- Develop ethical and legal governance
- 1 CA partner per project
- € 4-6 M, total € 40 M, Deadline 18 April 2018
Health topic 'SC1-BHC-01-2019'
"Understanding causative mechanisms in co- and multimorbidities"

- Validate mechanisms
- Exploit existing and generate new data
- Integrate lifestyle, behaviour, etc.
- € 4-6 M, total budget € 70 M
- Deadlines 2.10.18 & 16.4.19
Health topic 'SC1-BHC-25-2019'
"Demonstration pilot for implementation of personalised medicine in healthcare"

• Linking different actors & use multitude of data
• Show benefit, implementability, economic viability of Personalised Medicine in real life
• Going beyond cancer and rare diseases
• Pilot tailored to the needs of citizens
• **IA** for € 18-20 M, total € 60 M
• Deadlines 2 October 2018 & 16 April 2019
CLUSTER 1: Health

Everyone has the right to timely access to affordable healthcare of good quality (EU Pillar of Social Rights, UN SDGs).

3 Health challenges:

- **Threats to citizens and public health:** rise of non-communicable diseases; spread of antimicrobial drug resistance; emergence of infectious epidemics; health risks in a rapidly changing social, urban and natural environment

- **Sustainability of social and health care systems:** increasing costs for European health care systems; lack of effective health promotion and disease prevention; persistence of health inequalities, affecting disproportionally the vulnerable

- **Competitiveness of EU’s health and care industry:** personalised medicine approaches and digitalisation in health and care; increasing pressure from new and emerging global players in health innovation

These challenges are **complex, interlinked and global.**
CLUSTER 1: Health

6 Intervention areas:

1. Health throughout the life course
2. Environmental and Social Health Determinants
3. Non-Communicable and Rare Diseases
4. Infectious Diseases
5. Tools, Technologies and Digital Solutions for Health and Care
6. Health Care Systems
What is new?

- **Digitalisation and personalisation** of health and care cut across all intervention areas.

- **Health economics** and **health systems** are key for uptake of results and achieving impact.

- **Patient-centered solutions and technologies** for health and care call for integrated approaches from medicines to medical devices (supported in Horizon 2020 under the pillar ‘Leadership in Enabling and Industrial Technologies’).