Microbiome Biobank – Challenges and Opportunities

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Getting better, every day

TYKS Turku University Hospital

First official microbiome biobank in Finland

- Established 8/2018
- close collaboration with UTU (Institute of Biomedicine), Auria Biobank and Turku Bioscience
- State-of-art laboratory facilities in MedisiinaD building in Kupittaa Health Campus

AURIA BIOPANKKI

TYKS Turun yliopistollinen keskussairaala

TURUN YLIOPISTO

- The Hospital District of southwest Finland (VSSHP):
  - offers specialized healthcare to ~ 470,000 residents (28 municipalities)
  - Turku University Hospital *i.e.*Tyks (+ Salo, Raisio, Loimaa, Uusikaupunki), Turunmaa Hospital
  - approx. 30 laboratory units






TYKS Turun yliopistollinen keskussairaala

TURUN YLIOPISTO

TYKS Turku University Hospital

Collaborators

various departments and clinicians within **Tyks** (Gastroenterology, Gastrosurgery, Infectious diseases,, Hygiene unit, TYKSlab etc.)

cohort studies within POPC (Centre for Population Health Research)

- **Finnbrain birth cohort:** prof. Hasse Karlsson & Assoc. prof**.** Linnea Karlsson
- **Young Finns Study / STRIP Study:** prof. Olli Raitakari, adj. prof. Katja Pahkala
- **Terve Suomi:** prof. Teemu Niiranen
- **Hyvän Kasvun Avaimet,** SFBC: Adj. Prof. Hanna Lagström

Assoc.prof. Leo Lahti (bioinformatics, Dept. Of Computing/UTU)

University of Helsinki & HUS: **doc. Reetta Satokari (**HMRP) & **Prof. Perttu Arkkila**

Bioscience Turku: **FFGC** (doc. Riikka Lund & group), **metabolomics** (Adj. Prof Alex Dickens & group)

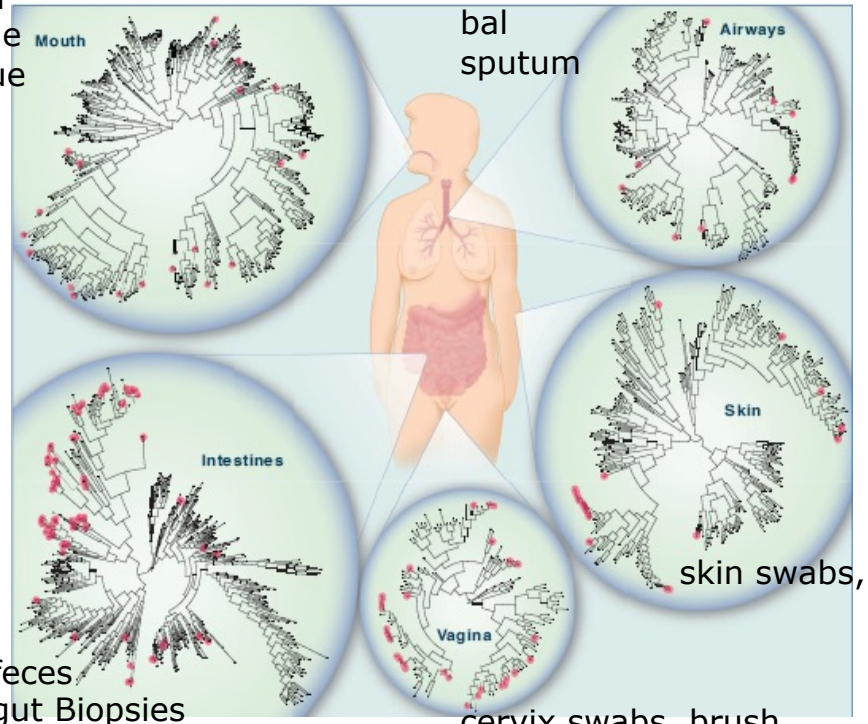
Savitripai Phele Pune University, **assoc. prof. Richa Ashma and prof. Ameeta Ravikumar**

University College of Cork, **Dr. Siobhain O'Mahoney, prof. John Cryan & prof. Ted Di**

”PEOPLE ARE NOT JUST PEOPLE. THEY ARE AN AWFUL LOT MICROBES, TOO” (The Economist 2012)

saliva
plaque
tongue

brush
bal
sputum



skin swabs, biopsies

feces
gut Biopsies

cervix swabs, brush
vaginal secretion
urine

Microbiota *= The ecological community of all micro organisms at a given site such as human intestine, mouth, skin, soil etc.*

Gut Microbiota *= one of the most diverse, and complicated ecosystems in Earth*

TURUN YLIOPISTO

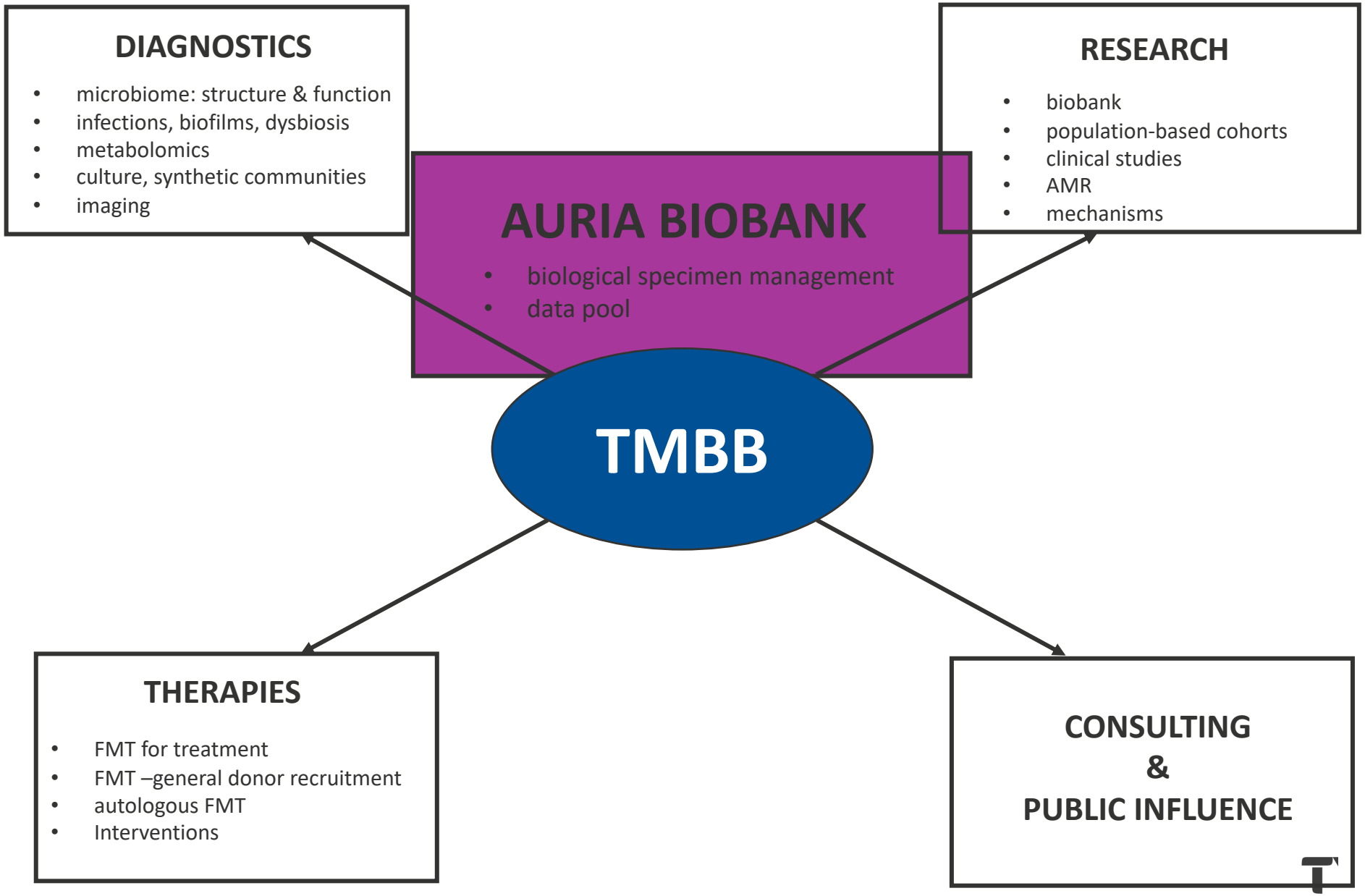
MICROBIOTA & DISEASES

GOOD EVIDENCE	MODERATE EVIDENCE
inflammatory bowel diseases	CVDs
inflammatory bowel syndrome	Alzheimer
colorectal cancer	Parkinson
obesity	depression, stress
type 1 and 2 diabetes	autism
athopy, asthma	co
NALFD	RA
antibiotic diarrhea	MS disease

Meri & de Vos (2015) *Duodecim* 131: 2091-8. & Lynch & Pedersen (2016) *NEJM* 375;24: 2369-2379

- recently decreased microbiota diversity has been linked to various life style and chronic diseases
- dysbiosis

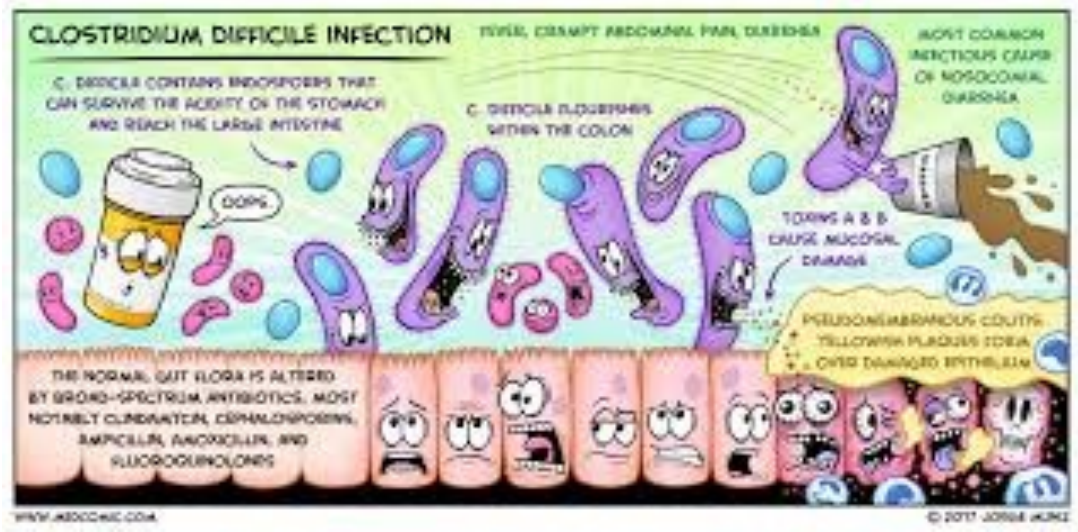
TURUN YLIOPISTO


DIAGNOSTICS
microbiome: structure & function
infections, biofilms, dysbiosis
metabolomics
culture, synthetic communities
imaging
RESEARCH
biobank
population-based cohorts
clinical studies
AMR
mechanisms
AURIA BIOBANK
biological specimen management
data pool
TMBB
THERAPIES
FMT for treatment
FMT –general donor recruitment
autologous FMT
Interventions
CONSULTING
&
PUBLIC INFLUENCE

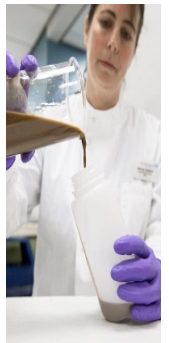
Our aims and operations

- preparation of the transplants for routine **Fecal Microbiota Transplantations (FMT)** (Tyks/other VSSHP units) → *i.e.* ultimate treatment of the **chronic *Clostridium difficile* infection**
- recruitment of so-called **general donors** for the FMTs (based on Cammarota G *et al.* consensus paper
- collection, handling, analysis, freezing and storage of above-mentioned general transplants

→ setting up a Finnish consensus for this together with other operatives **in FinFMT**



https://www.kevinmd.com/blog/2018/01/learn-clostridium-difficile-infect-medcomic.html



http://www.clostridiumdifficile.fi/SIRA_Files/downloads/Clostridium_difficile_EM.pdf

AURIA BIOPANKKI

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Who is a suitable general donor?

- age 18 – 60 years
- Body Mass Index < 27/8 kg/m^2
- no antimicrobial treatments (6 mo prior the collection)
- no chronic gastrointestinal diseases (IBS, IBD, coelic disease etc.)
- no autoimmune diseases (RA, T1D, MS etc.)
- no acute infections at the time of collection

→ massive laboratory testing prior the action: blood cell counts, CRP, gastrointestinal bacteria/virus/parasites, HIV, syphilis, hepatitis, liver enzymes, blood sugar, insulin, calprotectin etc.

Cammarota *et al.* (2017) Gut

Our aims and operations

- collection, handling, analysis, freezing and storage of **a variety of microbiota samples** in-line with similar approaches worldwide (Harvard Microbiome Biobank, American Gut, Elinav lab/Weizmann Institute & EMBL Heidelberg etc.)

- consultation of all the reseachers and clinicians interested in microbiota sampling, sample collections and analysis

- In the future: collection and storage of fecal transplants for **autologous FMT ?**

Sample collections, data pool

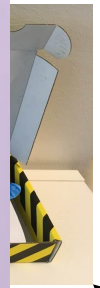
- Microbiological samples are received via 3 different routes:

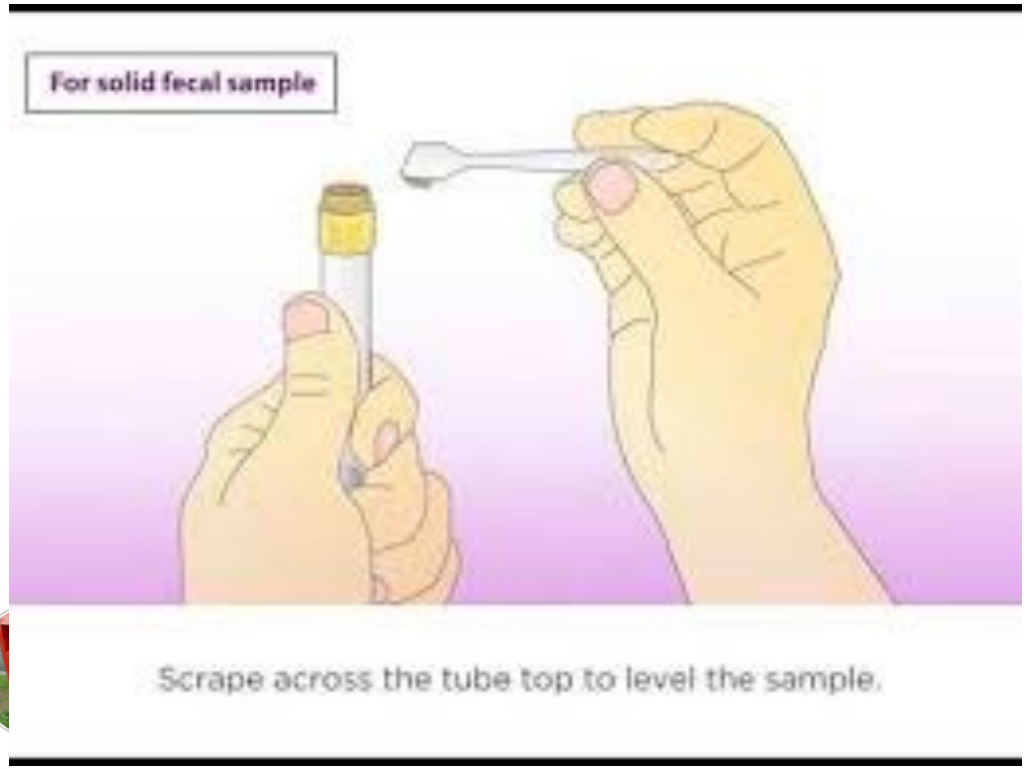
  - **Auria biobank (ABB) via signed consent** → currently samples can be only be stored, further analysis needs ethical approval
    - **questionnare data** at the same time (life style, diet, diseases, medications etc.)
    - **clinical data** including results of all other laboratory analyses can be incorporated to the microbiological data via ABB data pool → enables **personalized medicine,** provides clinicians modern kokonaisvaltainen tool for tailored treatments and interventions

  - **clinical research projects and cohorts (POPC)**: Tyks/gastroenterology, Tyks/gastrosurgery (appendicitis/**MAPPAC,** gastric by-pass surgery), Finnbrain, LASERI/STRIP etc.

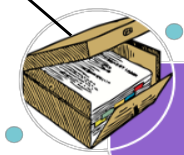
  - **Own sample and database** that could be utilized in order to characterize the microbiota of healthy, Finnish adult population
    - questionnare data at the same time (life style, diet, diseases, medications etc.)

Sample collection pipeline





Sampling at home



Sampling box sent via mail

Signed Auria biobank consent/study consent

Diagnostics – microbiome profiling

- development for both academic research and clinical diagnostics

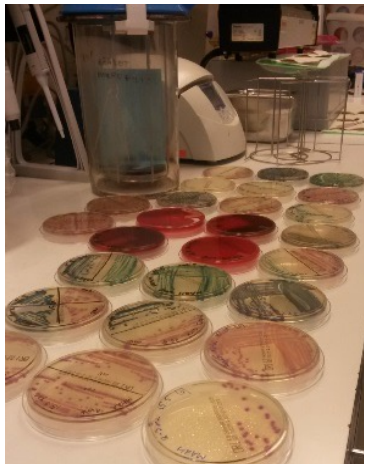
- Microbiome profiling:

  sampling pipelines
  targeted (in-house, V4): 16S (Illumina MiSeq)
  shotgun metagenomics: strain-level resolution, AMR profiling
  bioinformatics (CLC Genomics workbench for diagnostic use), **looking for professionals, collaborators and partners!**

- targeted, accurate, quantitative testing for clinical purpose → dysbiosis (bacterial vaginosis, inflamed skin, nasal cavity/pharyngitis/otitis media etc.)

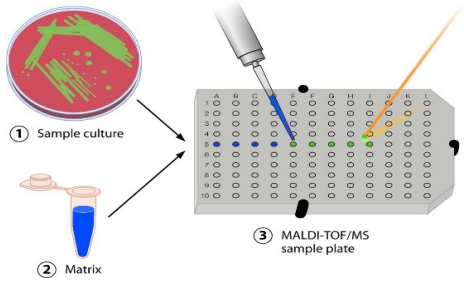
Diagnostics – metabolomics, culture

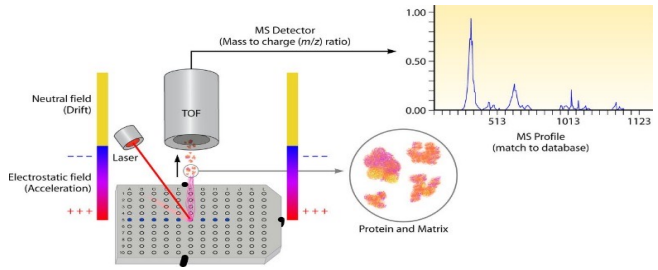
- Stool metabolomics pipeline development in collaboration with Turku Bioscience: GC + TOF & LC



+ serum metabolomics: new potential infection biomarkers ?

- Culture + MALDI-TOF in the validation of previously mentioned diagnostic testing



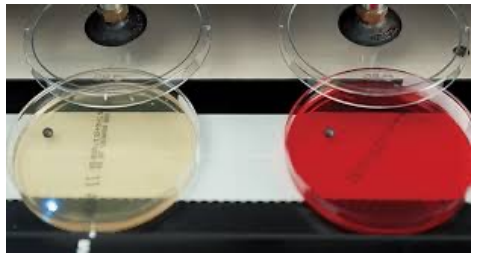


Bacterial identification

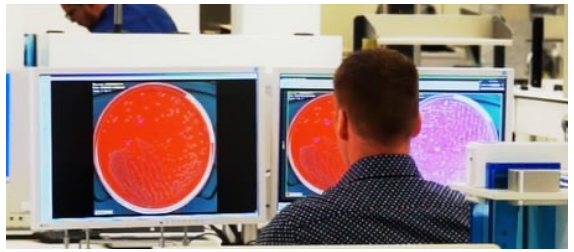
Andrew E. Clark et al. Clin. Microbiol. Rev. 2013; doi:10.1128/CMR.00072-12

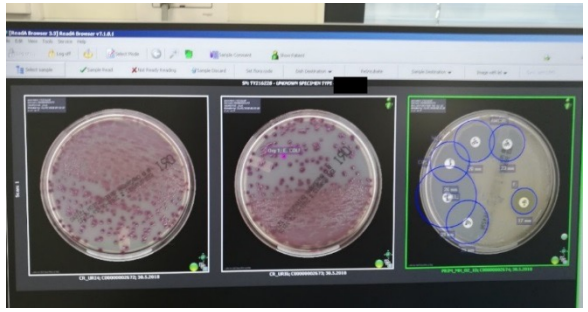
Automated bacterial culture, first in Finland

Tyks, Clinical microbiology

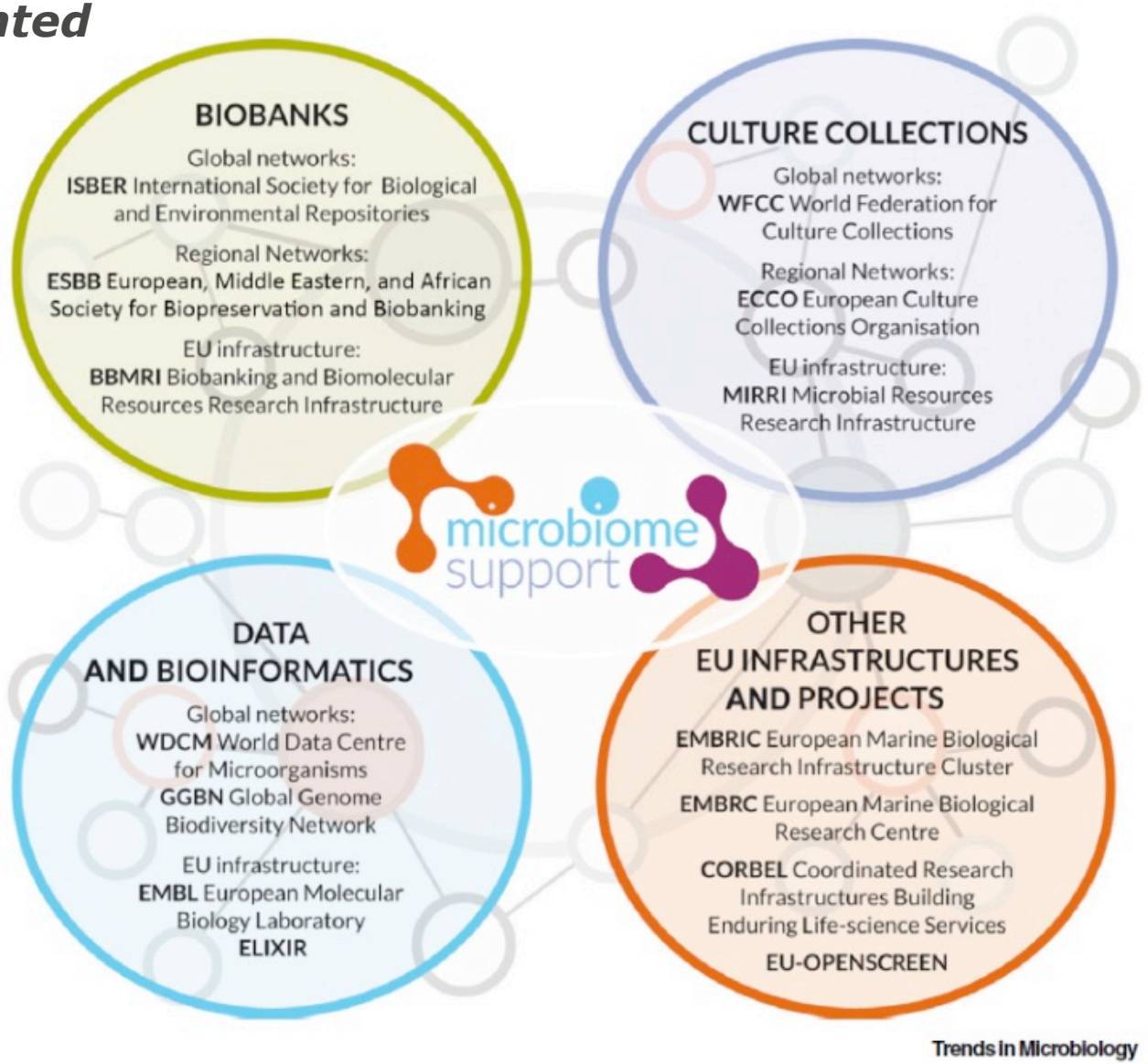


BD Kiestra



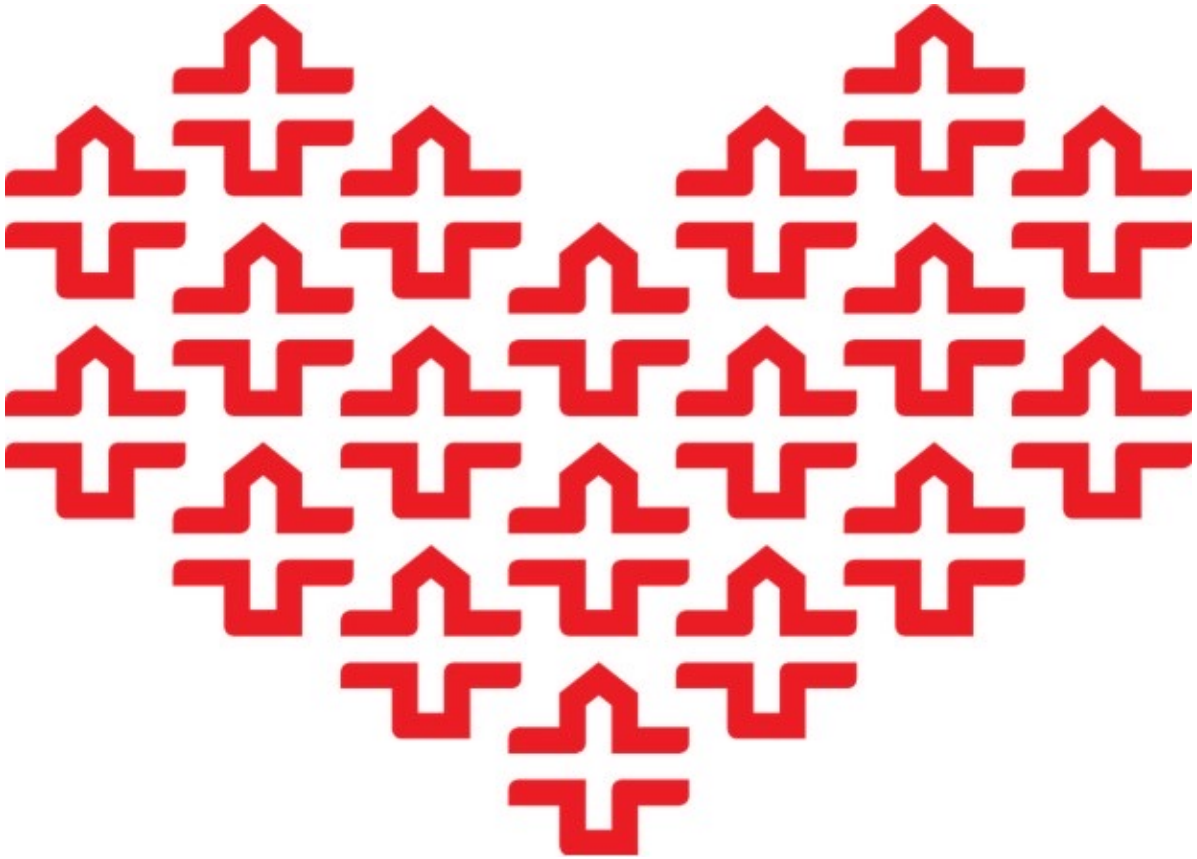


The current European and international landscape underpinning microbiome research is fragmented



Source: *Ryans et al.* Trends Microbiol, 2021

Thank you!



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