

A brief introduction of Korean microbiome projects

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Global status of gut microbiome field

National microbiome projects

Human Microbiome Project (2008-2013)

- Main roadmap project of NIH (USA)
- About 114 million \$ of research fund
- Completely analyzed the microbiome of 18 body sites from 242 Americans



2nd round national microbiome project



Population level microbiome studies

Population-level analysis of gut microbiome variation

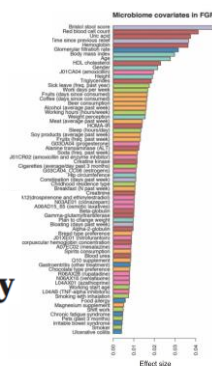
Belgian Flemish Gut Flora Project (N = 1106)

Falony et al., 2016, Science

Population-based metagenomics analysis reveals markers for gut microbiome composition and diversity

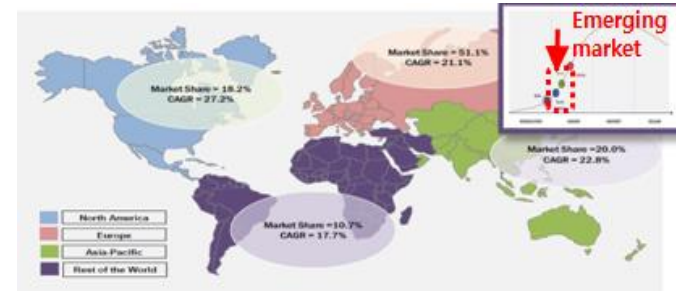
Dutch LifeLines-DEEP study (N = 1135)

Zhernakova et al., 2016, Science



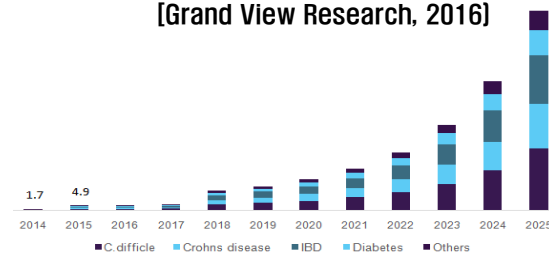
Microbiome market

AGR of World microbiome market: 22.3%
(Markets and Markets, 2016)



U.S. Microbiome therapeutics market, by application, 2014 - 2025 (USD Million)

(Grand View Research, 2016)



- ✓ For the purpose of developing **diagnostics** and improving **human health**
- ✓ Correlation of **genomic data and Gut microbes** related to human health
- ✓ To develop **Public health care and new industrial market**

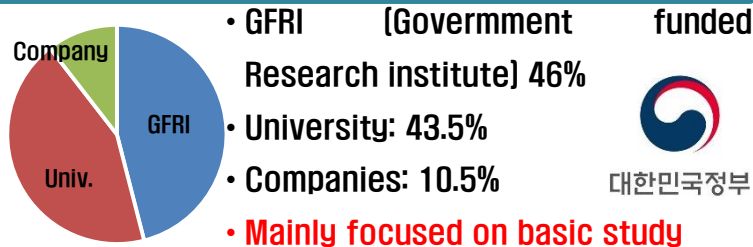
Current research status of Korean microbiome

R&D fund scale on microbiome

Investment status by governmental departments

- Ministry of Science and ICT: 15 million \$
- Ministry of Agri, food and rural affairs: 5 million \$
- Ministry of trade, industry and energy: 1 million \$
- Ministry of health and welfare: 2 million \$
- **Total: 20 million \$ (about 1% of total Bio R&D budget)**

Investment status by research participants



Main research project

- Bid & technology development program (Ministry of Science and ICT) includes **"microbiome banking"**
- Basic projects of GfRI (Ministry of Science and ICT) includes **"Host-microbe interaction"**
- Post-genome project (complexed departments) includes **disease treatment based on microbiome**

Governmental R&D and industrial policy

New Policies and projects for microbiome

- New project: Microbiome banking project **[2016~]**
- New project: Biomedical technology development project **[2017~]**
- Korea Bio-Economy initiative: selected microbiome as innovative research area **[2017~]**



Industrial responses on the governmental policy

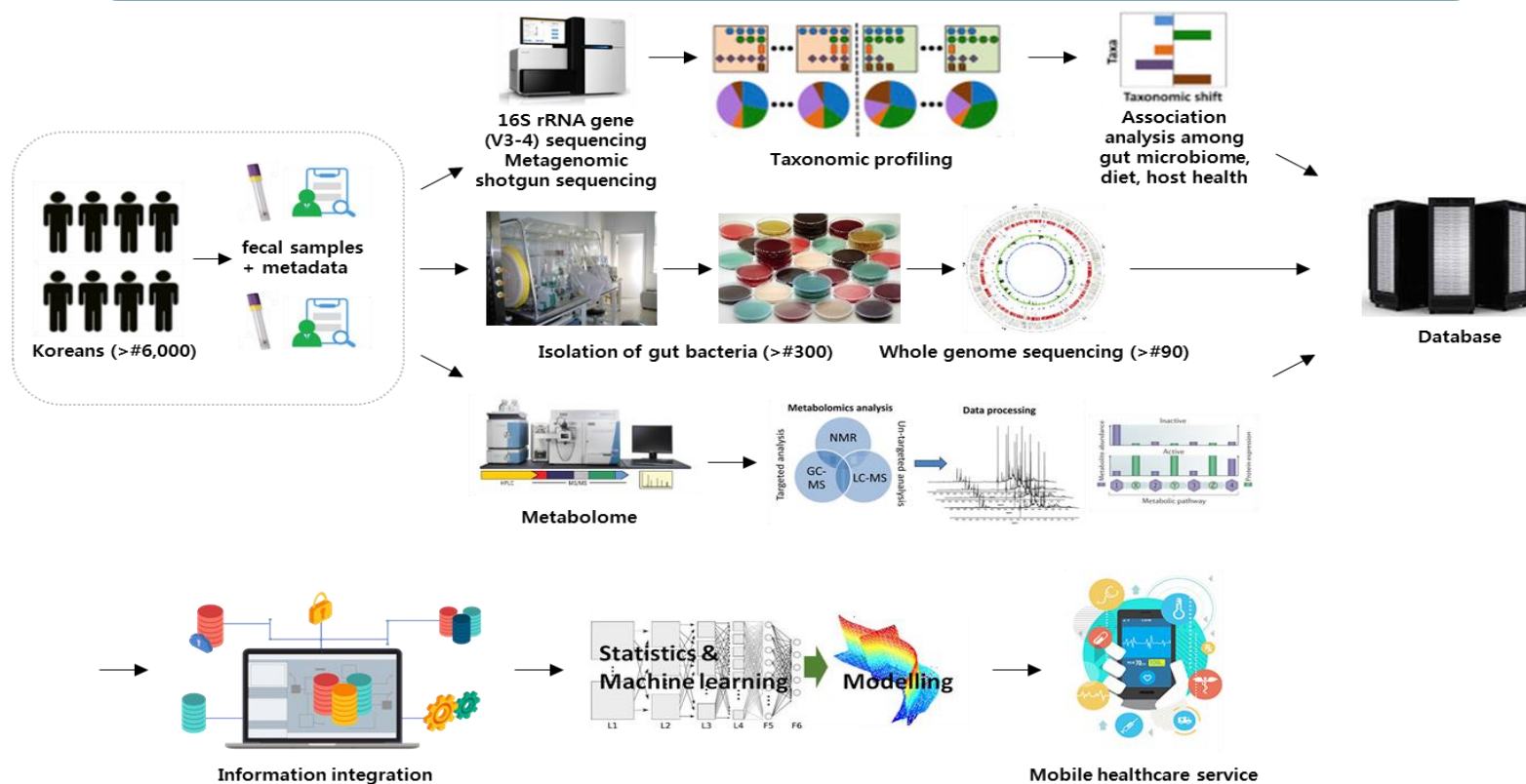
- **CJ**
Establishment of research center for probiotics
- **CK pharm**
Constructing microbiome bank collaborating with SNU
- **Ildong pharm**
Set up new research institute for microbiome research
- **Kobio**
Establishment of New drug development pipeline
- **Chunlab**
Launch Bioinformatics analysis clouding service



Microbiome project of KFRI (2017-2025)

Development of pharmabiotics and mobile healthcare platforms based on human gut microbiome

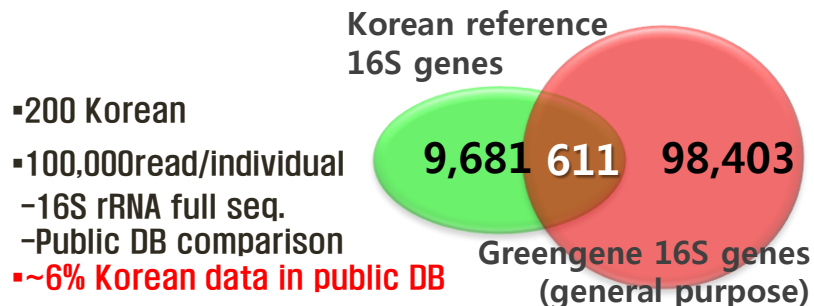
- This project aims to
- 1) develop a new diagnostic technology for diseases,
 - 2) suggest microbiome modulation strategies and lifestyle guidelines according to gut microbiome types, and
 - 3) develop a mobile service incorporating diagnosis and healthcare solution, based on Korean gut microbiome data.



Microbiome project of KFRI (2017-2025)

Korean microbiome database construction

Analysis of Korean microbiome database



Collecting metadata with microbiome data

- Health examination items
- 206 Questionnaires
 - Diet calorie
 - Food group information
- Athletic ability/Depression (aged only)
- Non targeted blood metabolite



Collecting big Korean microbiome data

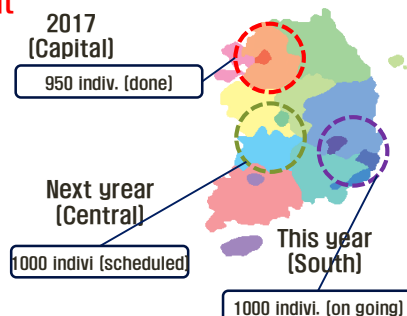
Voluntary participation

- Questionnaires about basic, diet, lifestyle, medication history, physical condition, Experience of disease
- 2017~2019: **3,000 participant**



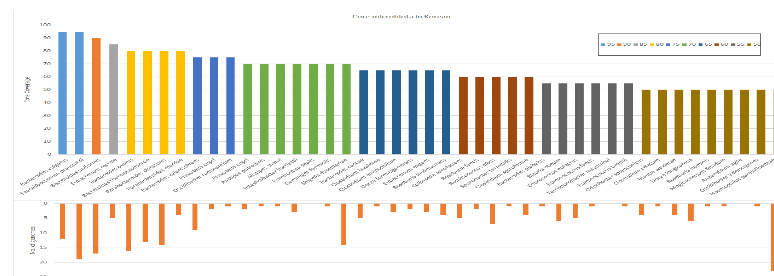
Clinical participation

- Regional studies for capital, central and south area of Korea
- 1,000 individual/year**



Genome analysis of Korean core gut microbiota

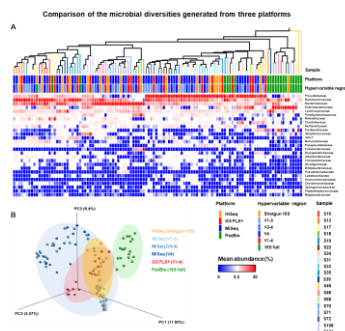
- Targeting 44 species level core taxon
- Largely distributed species (more than 50% of indiv.)
 - about 100 complete genome (50 genome/year)
 - comparison with foreign or environmental strain
 - functional gene identification
- Used as reference genome for metagenome analysis



Microbiome project of KFRI (2017-2025)

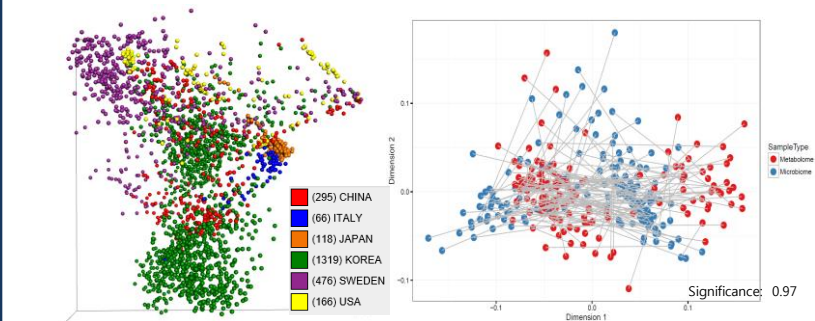
Developing microbiome analysis process

Optimization of NGS analysis process



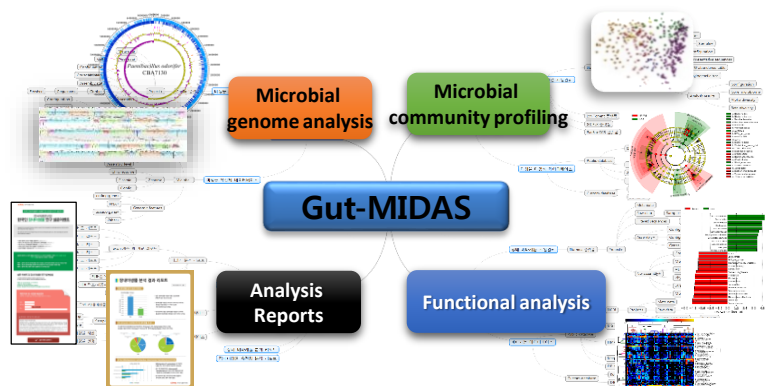
- NGS analysis
 - Comparison of NGS platforms
 - Comparison of each 16S rRNA gene regions
- Analysis process
 - Sampling methods
 - DNA extraction protocol
 - Preparation period

Microbiome and metabolite analysis



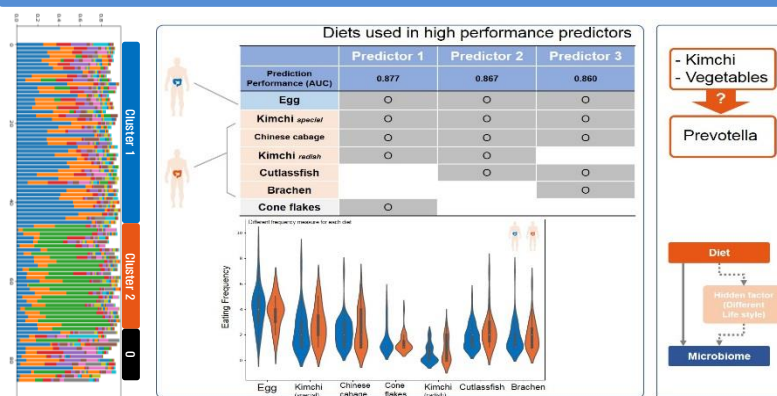
- Comparing Korean microbiome with foreign individuals
- Microbiome/metabolite network analysis

Gut-MIDAS: Automated analysis pipeline



- Automated microbiome analysis pipeline
- Use Korean microbiome database

Prediction by machine learning



- Microbiome enterotypes and metadata analysis
- Diet/microbiome association (predictors)

Summary

- **Global status of gut microbiome field**
 - Gut microbiota is highly **related to health and various diseases**
 - Many countries have **microbiome information** about their own people
 - Global microbiome market is **rapidly growing**
- **Current research status of Korean gut microbiome**
 - Various **Korean governmental departments are investigating** on microbiome
 - Korean government has been presented **some new R&D policies** on microbiome
 - Related **companies are also increasing microbiome investment**
- **Microbiome project of KfRI**
 - Current information of **Korean microbiome is still insufficient**
 - KfRI has began Korean microbiome project **constructing microbial database and developing healthcare platform** based on Korean microbiome



Thank you.

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