Digital Soil
Project Proposal

From Molecules to Ecosystem
Digital soil can be seen as the next technology step for:
- understanding impact of soil on pesticide activity/uptake
- product placement and optimization
- developing farming solutions: soil profile is a prerequisite
- Meeting requirements for registration of new products

Collaboration partners @ Bayer across functions are sharing this view:
- Collaboration with the leading academics experts
- Precompetitive part of the project with members in the AgriTech Consortium
**Transformation from classical Soil studies to Digital Soil**

Opportunity to start working on a game changer technology with leading experts & precompetitive across industry

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**Internal Datasets**
- Field stations:
  - 10000ths of soil samples measured

**Data Generation @ Internally**
- In house Metagenomics sequencing of soil

**Wet lab Soil Characterisation**
- Physicochemical and biochemical, not molecular
- High number of soil experiments for potential products, metagenomics missing

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**Analysis Pipeline & Data Platform**
- Integration of 10ths of in house and 10ths of public datasets
- Sustainable solution
- NEW Metagenome Expression in High throughput to test chemical compounds
- Sludge analysis replacing long term soil studies – to be discussed

**Deliverables**
- New Biotransformation solutions: enzymes, organisms
- Mechanistic understanding of SMol products: reading the environmental fate in ecosystems at the molecular level
- New solutions: targeted biodegradation
- Discovering new traits and biologics via biosynthetic gene clusters
Digital Soil - Key Activities

- **Data Platform**
  - Integration and analysis internal data, analysis of both public and internal data to generate soil profiles
  - Enzymes, organisms, toxins, natural products, traits, biologics

- **Biosynthetic gene clusters**
  - Wet Lab Screening new chemistry – fate in soil, HuSa, Soil Health

- **Soil samples**
  - Metabolite Identification
  - Compound Testing
  - Metabolite Identification
  - Soil Functional Standards

- **EML Data Platform**
  - MGNify
  - Bioinformatic workflow for functional annotation incl. soil

- **Soil Sequencing at company x**
  - starting at 20$/sample

- **Classical Soil Characterization**

YOU?!
## Digital Soil - Project Proposal -

<table>
<thead>
<tr>
<th>Data Platform</th>
<th>Outputs / benefits</th>
<th>Indicative duration &amp; Resources</th>
<th>Potential partners</th>
</tr>
</thead>
<tbody>
<tr>
<td>// Collaboration with EMBL Computational metagenomics and analysis group, EMBL (Rob Finn)</td>
<td>// Collaboration with EMBL M. Zimmermann group</td>
<td>// Runtime: 2 years</td>
<td>Bayer</td>
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<tr>
<td>// MGNify data platform</td>
<td>// Screening method: from metagenomes to environmental fate of compounds</td>
<td>// 1 Postdoc @ EBL* Private instance platform, data integration, science</td>
<td>Agritech Consortium:</td>
</tr>
<tr>
<td>// integration internal and public data</td>
<td>// Screening degradation of chemical compounds by human gut enzymes</td>
<td>// 1 Postdoc @ Bayer: Bayer data, IP relevant topics</td>
<td>// Founding partners Syngenta, Bayer, EMBL</td>
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<tr>
<td>// Adaption MGNify towards Agritech context</td>
<td>// functional annotation of soil: reducing the complexity of soil</td>
<td>// Maintenance MGNify</td>
<td>// open to consider proposals from new members of the AgriTech Consortium willing to join the project.</td>
</tr>
<tr>
<td>// Cataloging datasets to answer specific questions</td>
<td></td>
<td>// 1 FTE lab Technician @ EMBL, M. Zimmermann group</td>
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</tbody>
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* Option to share the postdoc(s) with partners
External Knowledge as integral part
Collaboration partners, Solutions in use and accompanied projects

Michael Zimmermann
Group Leader, EMBL
Metabolic microbiome host interactions
FEBS Anniversary price 2021
ERC Starting grant 2022
Collaboration Partner

Robert Finn
Section head EMBL-EBI's Microbiome Informatics
Group leader Metagenome research
Collaboration Partner

Innovation Projects @ Bayer
LSCs project funded 2023:
Metabolization pred. tools
Soil knowledge graphs
Bayer Pharma, CS,
Consumer Health,
E&T
Solution & Collaboration

Pistoia Alliance project
Microbiome
Ongoing: Data Mining new enzymatic reactions
Results public available
Extension scope towards crop science proposed
Thank you for your attention!