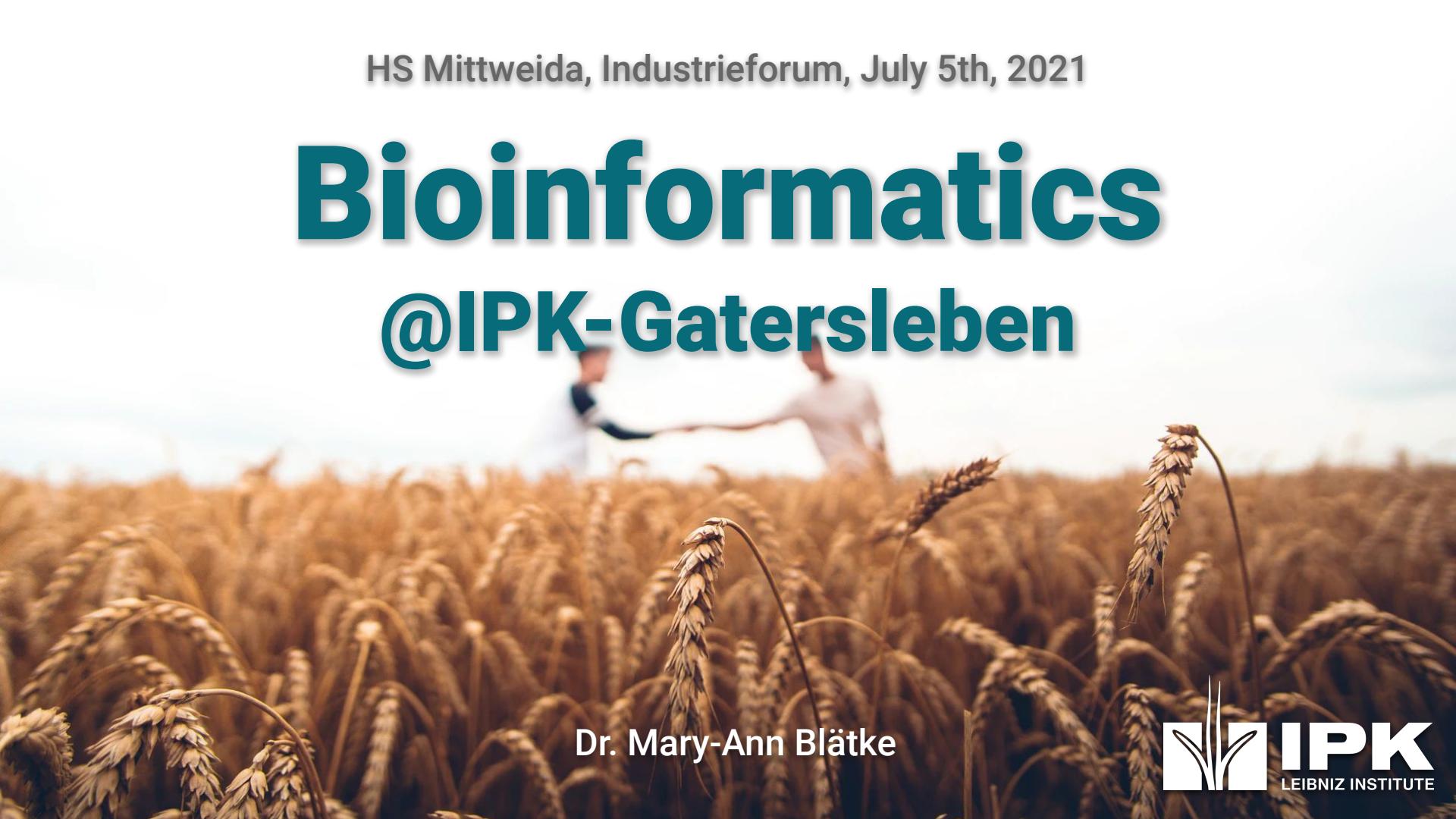


HS Mittweida, Industrieforum, July 5th, 2021

Bioinformatics

@IPK-Gatersleben



Dr. Mary-Ann Blätke





Hello!

My name is *Mary-Ann Blätke*, I am leading the Young Investigators Group *Integrated Mechanistic Models* at *IPK Gatersleben*.

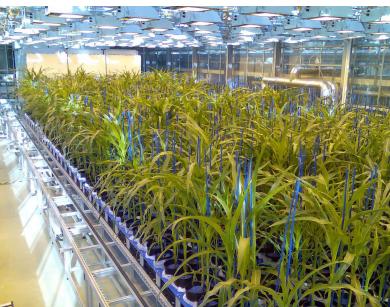
I am a dedicated *computational biologist* with 10+ years experience in integrative modelling and analysis, as well as web- and database development.

@MaryAnnBlaetke





Infrastructures



Agriculture is
a major driver
for innovations
in technology





Oxygen



Nutrition



Energy



Raw Materials

Climate Change

Overpopulation

Climatically-Adapted, Resistant and Resilient Crops





WEATHER DATA

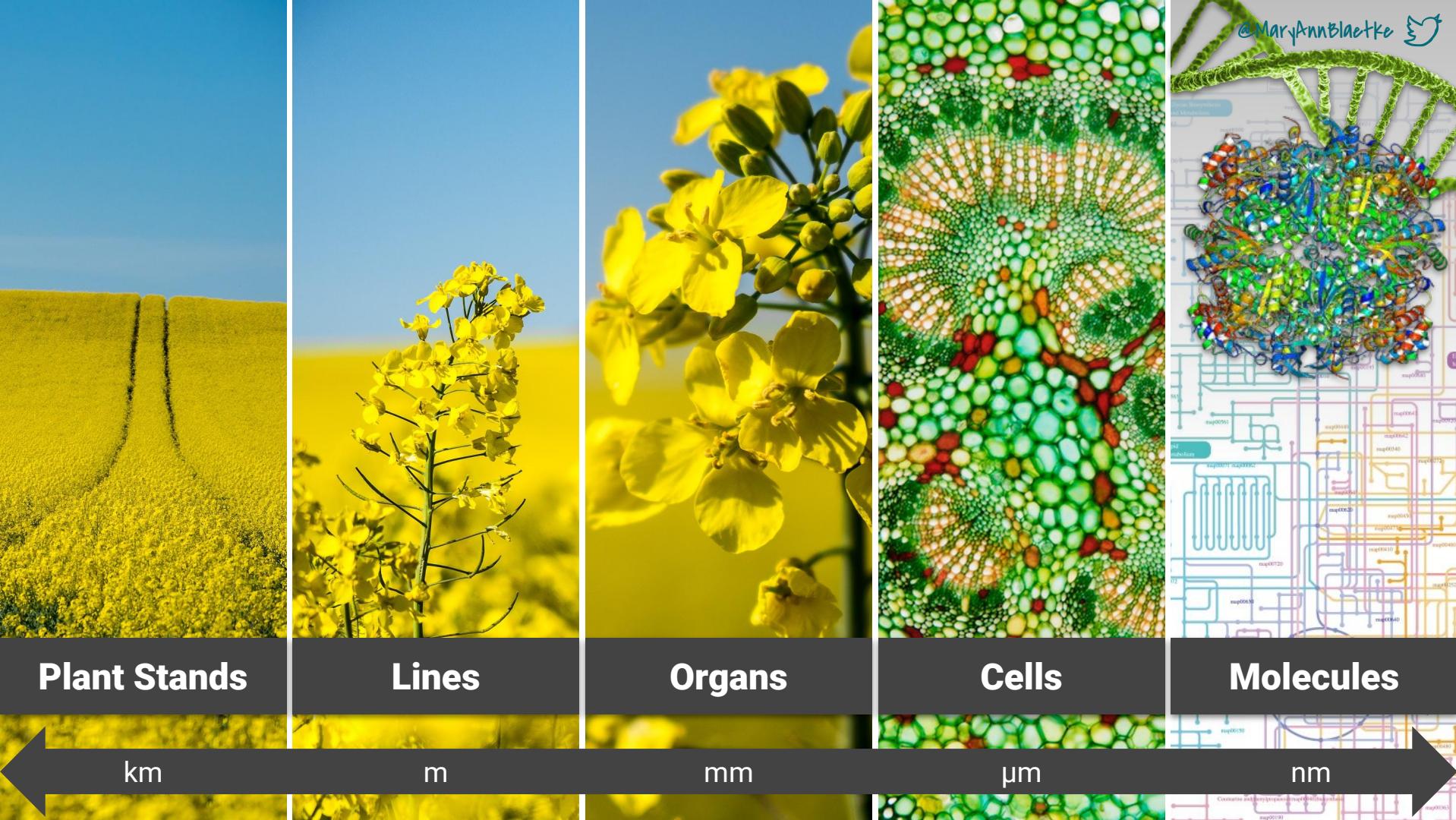
OMIC ANALYSIS OF
PLANT ORGANS

GENOME
SEQUENCING

SOIL CONTENT
FERTILIZER
WATERING



WHOLE PLANT LIFE CYCLE





**Data Volume
Data Modalities
Data Diversity**



Data



Knowledge

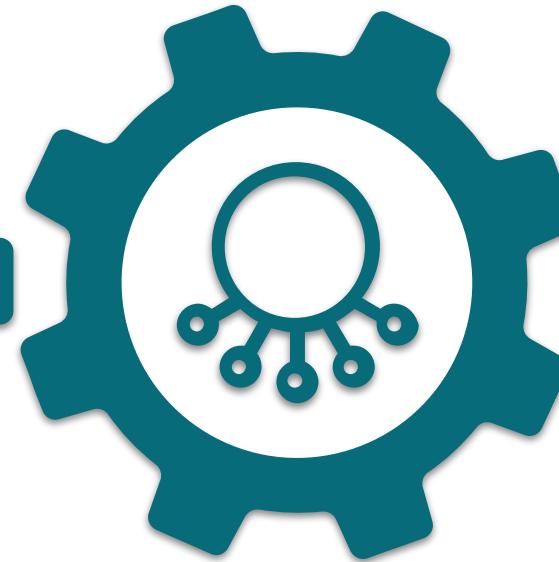
Bioinformatics



**Data
Management**



**Computational
Biology**



Data Management

Data Assessment

- Molecular Omic Platforms
- Sequencing Platforms
- Phenomics Platforms

Data Storage

- Digital lab books
- Databases
- File storage

Data Curation

- Data structure/format
- meta-information.

Data Access

- Permanent unique identifiers
- API's
- GUI's



=> *Support FAIR Data along the Research Pipeline*

Bioinformatics

Development

- Algorithms
- Tools
- Pipelines

Analysis

- Statistical Models
- Machine Learning
- Deep Learning

Functional Annotation

- Genes
- Proteins
- Metabolites

Structure Prediction

- Macromolecules
- Proteins



=> *Discover Patterns (Information) in Data*

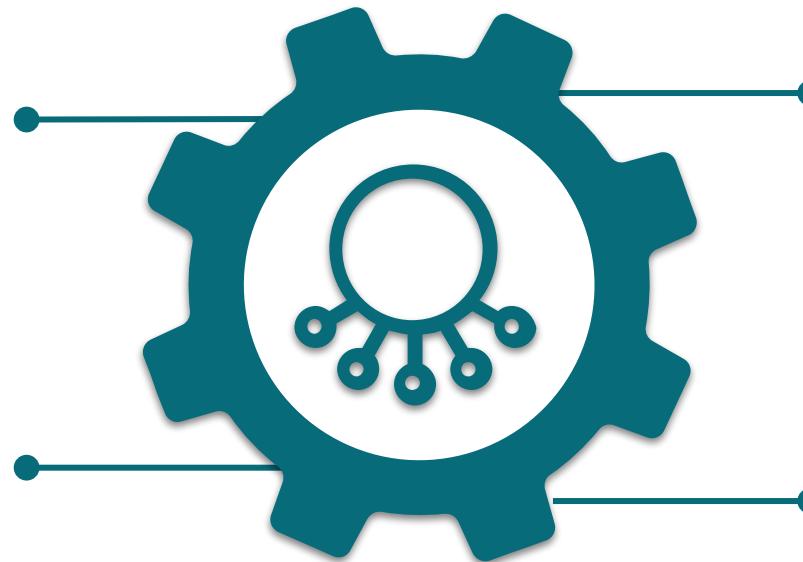
Computational Biology

Networks

- Interaction network
- Gene regulatory networks
- Signalling networks
- Metabolic networks

Mathematical models

- ODE, PDE models
- Formal/rule-based models



Data/Model Integration

- Multi-omic Models
- Multi-scale Models

Analysis & Testing

- Graph Theory
- Linear Optimisation
- Simulations

=> *Integrate Information in Models, Test Hypothesis*

Digital Plants

- Understanding plants life cycle
- Unravel genome to phenotype molecular mechanism
- Test and predict effect of changed factors



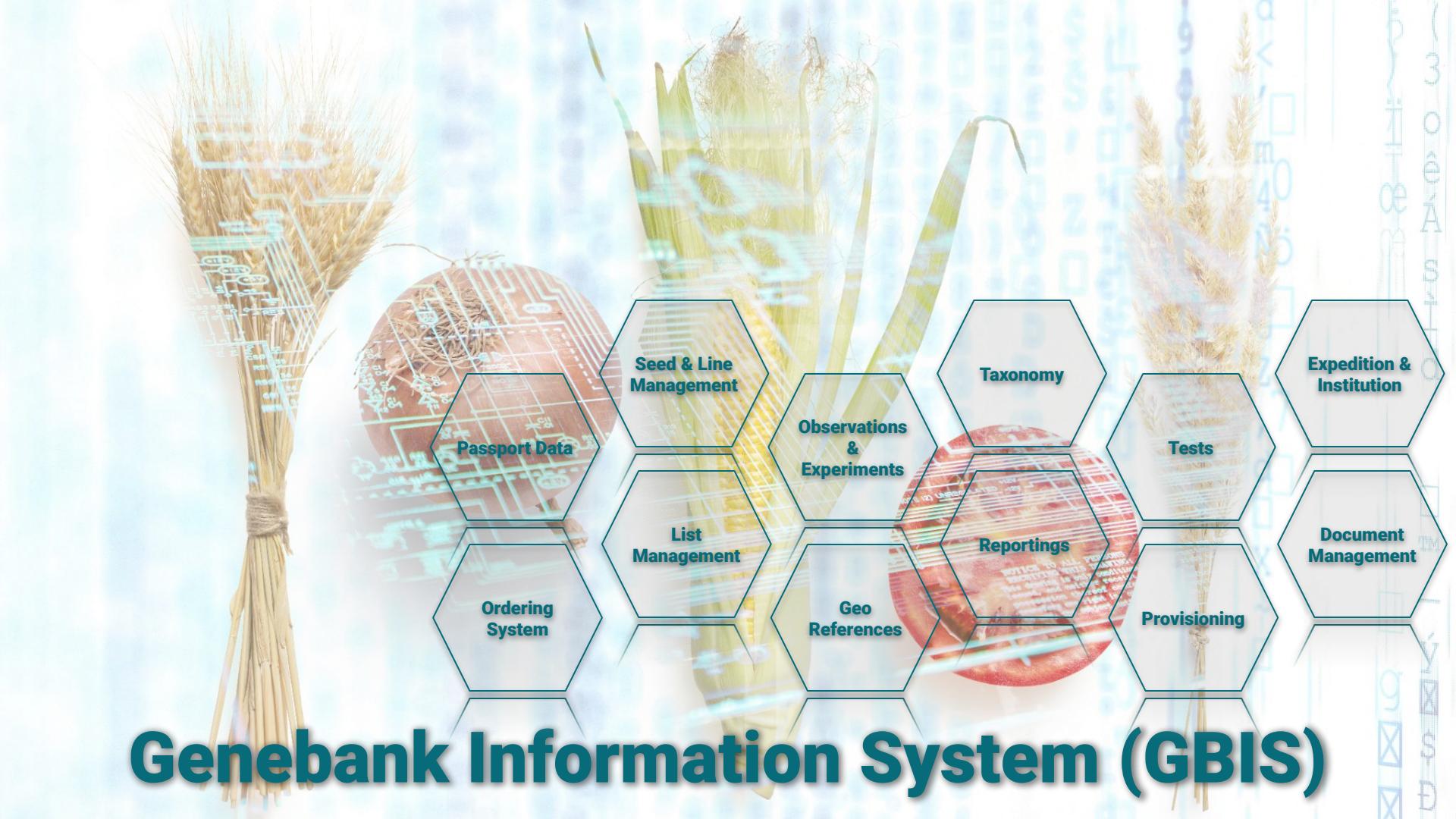
Digital Breeding

- Breed Elite Crops
- Shorten Breeding Cycles
- Adapt Breeding Strategies

"Totaling 151002 accessions from 2933 species and 776 genera the IPK Genebank holds one of the largest collections of crop plants and their wild relatives."

Treasure of Biodiversity and Genetic Diversity

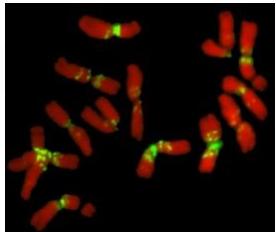
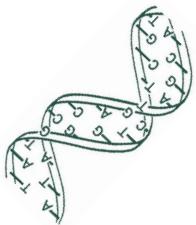




Genebank Information System (GBIS)



Genotype

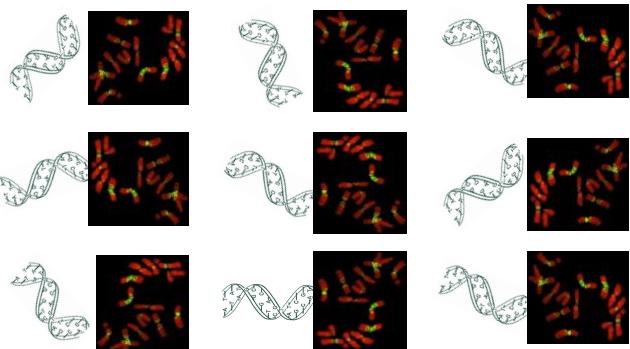


Phenotype



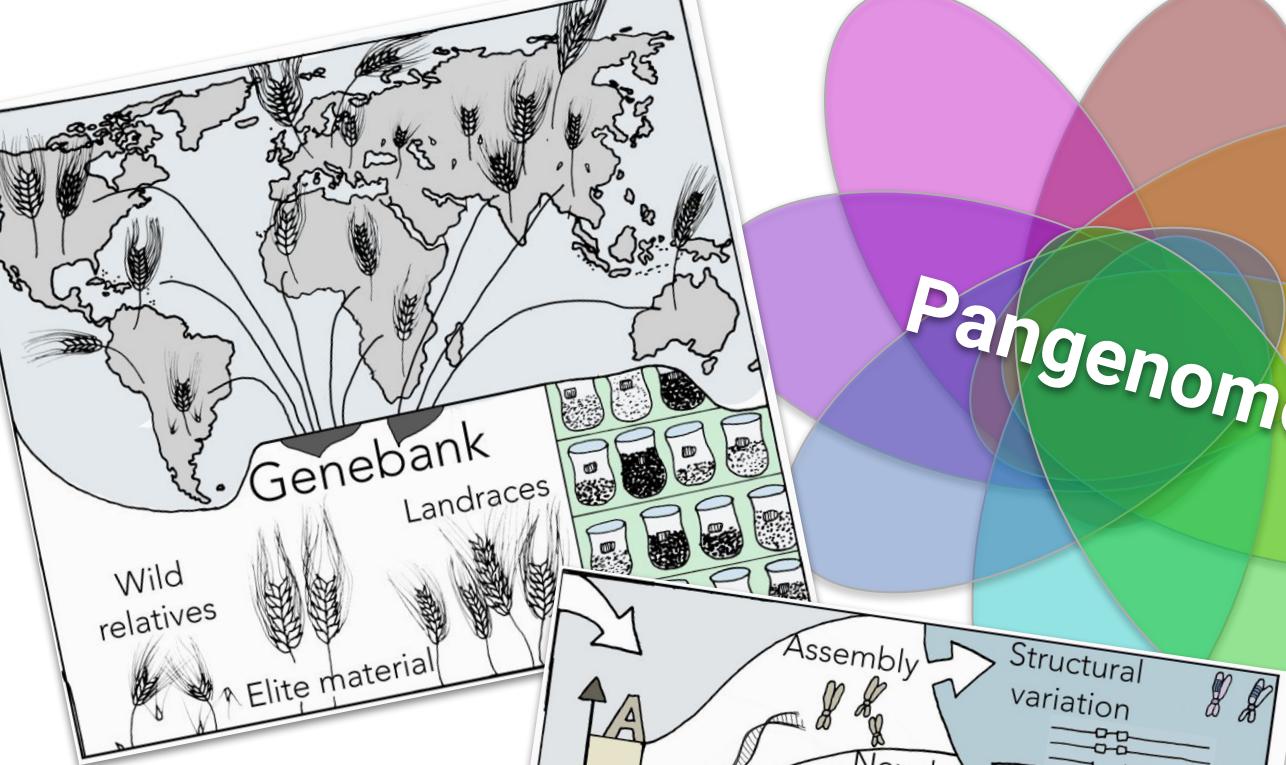
...not one, but MANY barley
accessions...

Genotypess

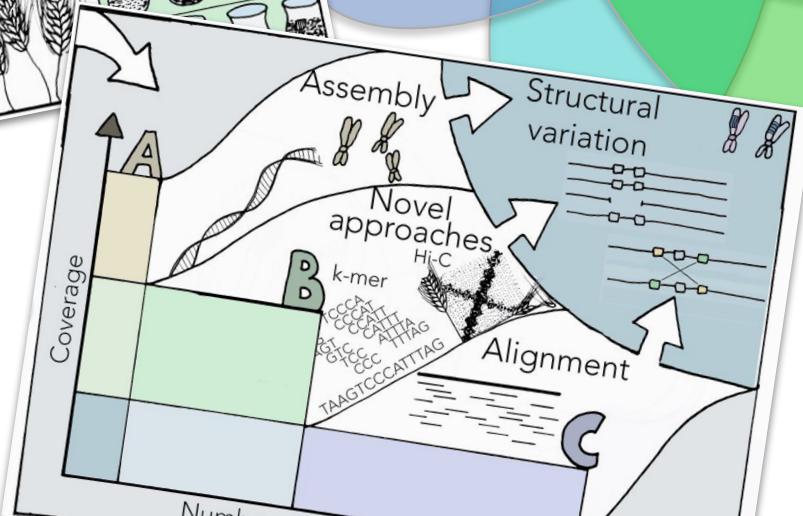


Phenotypess





Pangenome



Levels of Phenotyping

Cell-Level



...CELL SHAPES
...TISSUE PATTERNS
...TRICHOMES
...TRANSCRIPTS
...PROTEINS
...METABOLITES

Levels of Phenotyping

Organ-Level



- ...LENGTH
- ...ANGLE
- ...CURVATURE
- ...SURFACE/VOLUME
- ...BIOMASS
- ...CONTENT
- ...STRESS LEVEL

Levels of Phenotyping

Plant-Level



- ...HEIGHT
- ...BIOMASS
- ...NUMBER OF LEAVES
- ...GROWTH RATE
- ...PHOTOSYNTHETIC ACTIVITY

Levels of Phenotyping

Field-Level



...STRESS-LEVEL
...PESTS
...YIELD
...YIELD STABILITY

Genotype

Phenotype



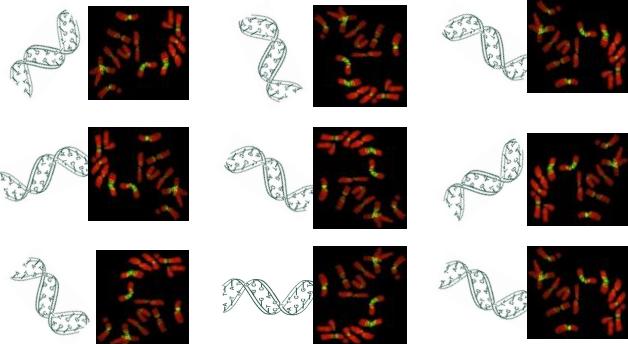
ENVIRONMENT

..not one, but many

Phenotype = Genotype x Environment

phenotypes

Genotypes



LIGHT QUALITY +
QUANTITY

TEMPERATURE

CO2 LEVEL

HUMIDITY

WIND SPEED

WATERING

Plant Cultivation Hall

Field-like & Controlled Environments

Shoot Phenotyping

Root Phenotyping



- RGB imaging
- 3D laser scanner
- Kin. CHL-Fluor.
- HyperSpec. imaging

Container-based system with PhenoCrane

Rhizotron system with PhotoChamber

- Shoot RGB imaging (top, side)
- Root monochrome imaging

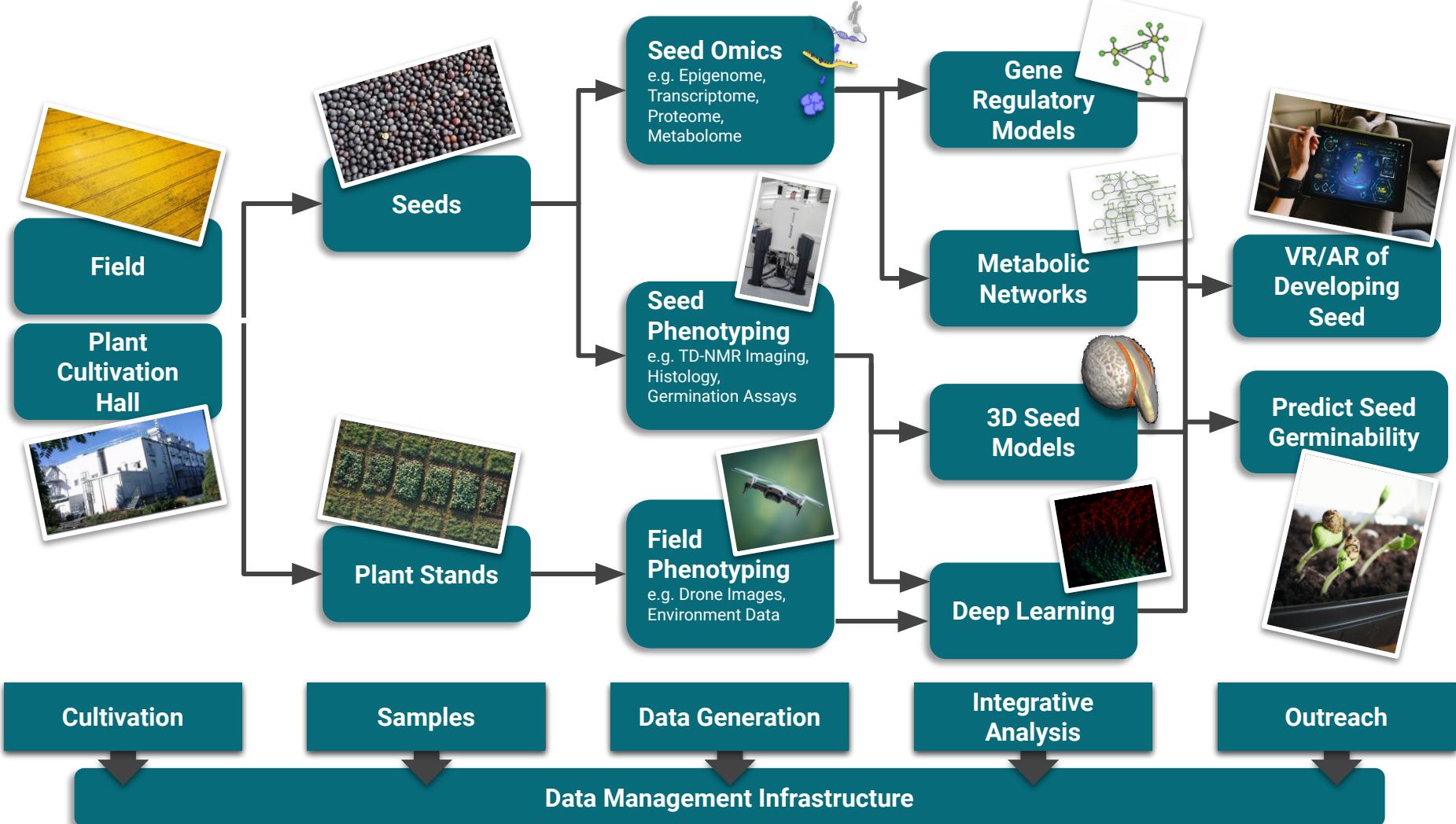




AVATARS

Exploration of rape seed research in a virtual environment!





Innovations in breeding rely on
data management and deep
computational approaches.



Sustainable Future





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- PhD Thesis

Please, contact us:

SZYMANSKI@IPK-GATERSLEBEN.DE
(Computational & System Biology)

SCHOLZ@IPK-GATERSLEBEN.DE
(Computer Science, Bioinformatics)

We want you in our Team!

Or check:



<https://bit.ly/ipk-thesis>

Thank you!



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@MARYANNBLAETKE



THIS-IS-MARY.COM