

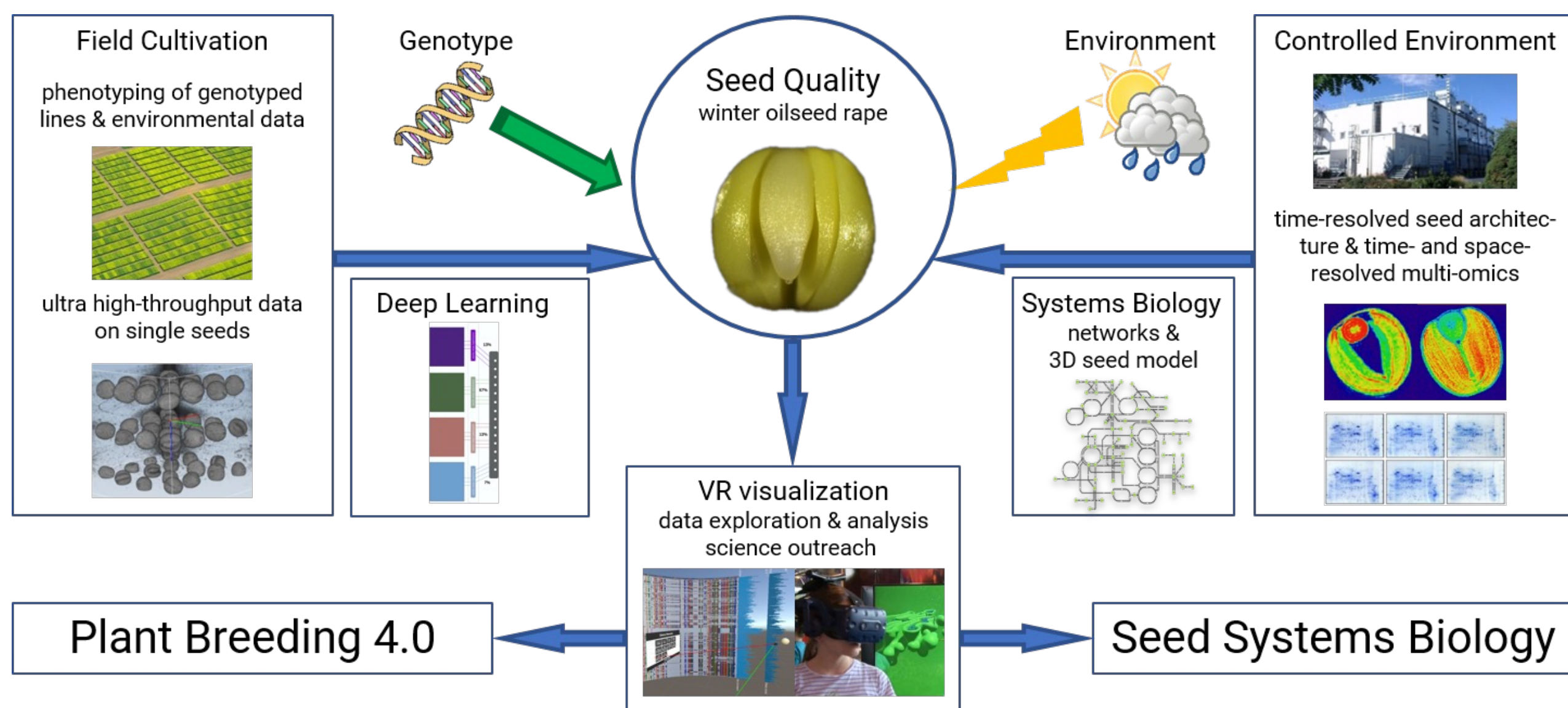
AVATARS

Advanced Virtuality and Augmented Reality Approaches in Seeds to Seeds



Goals

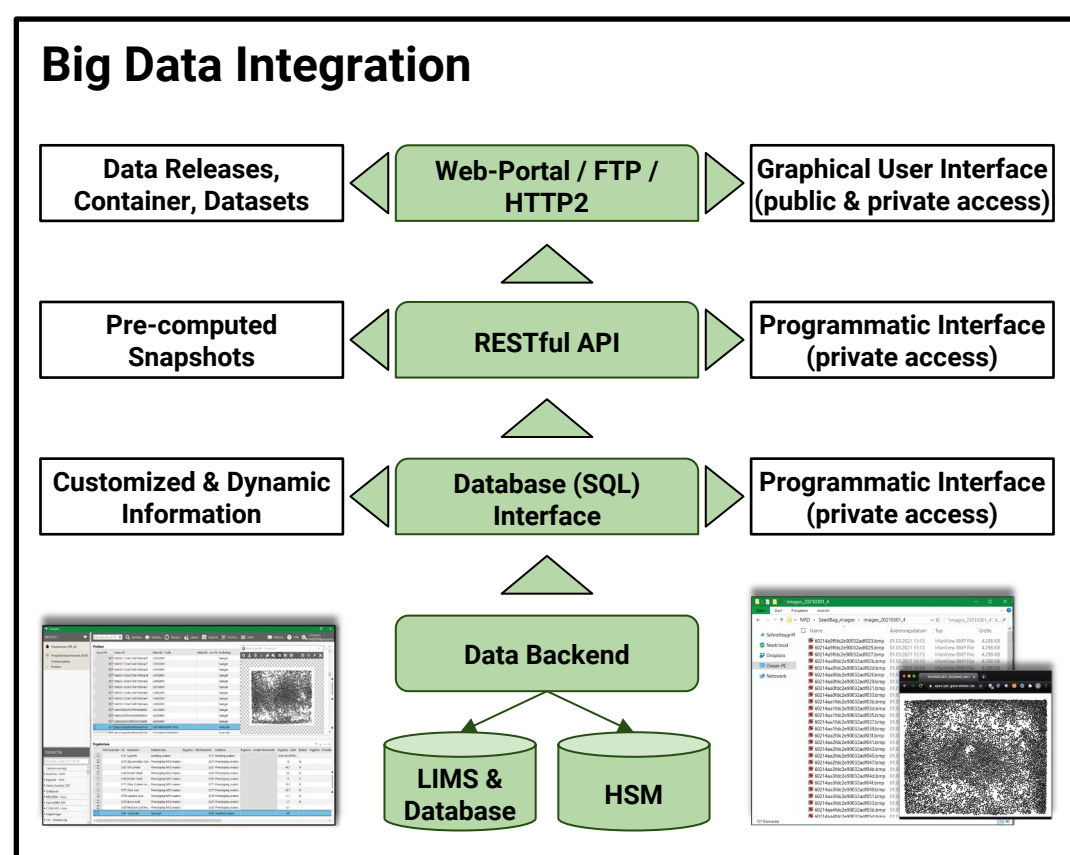
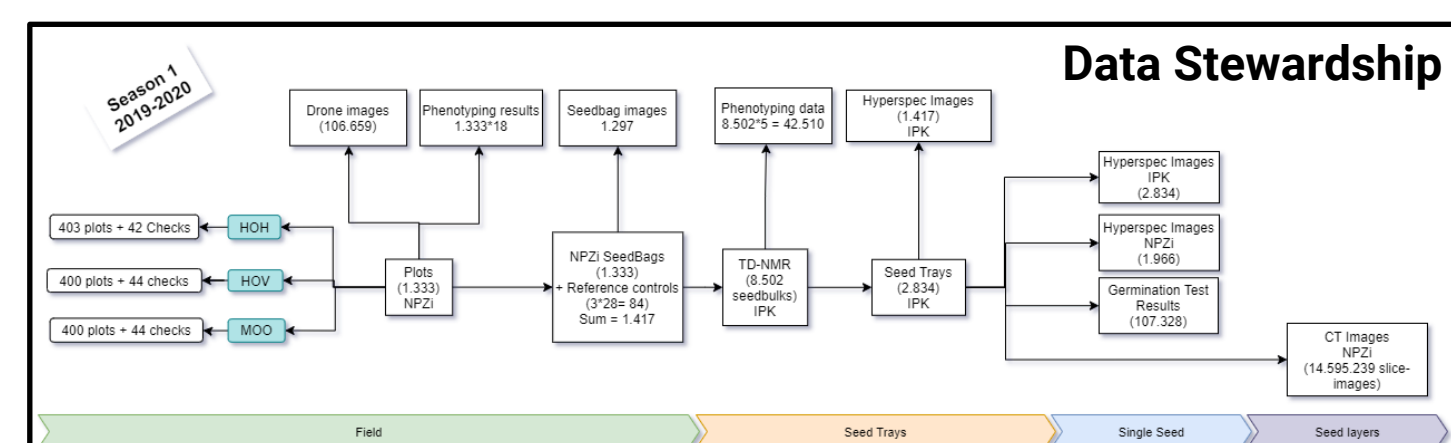
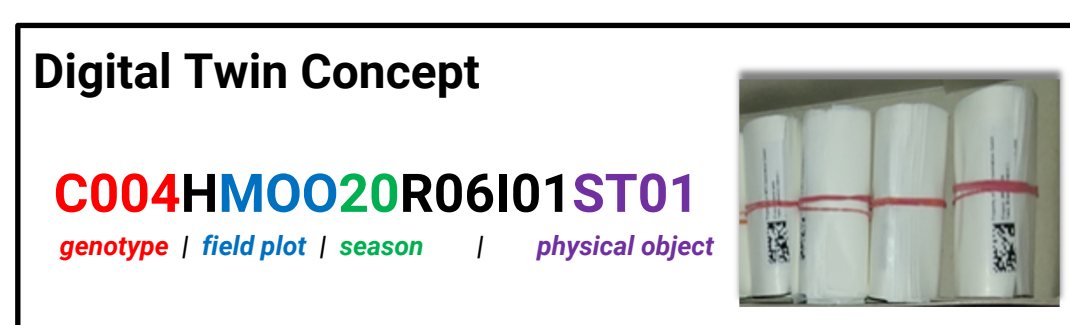
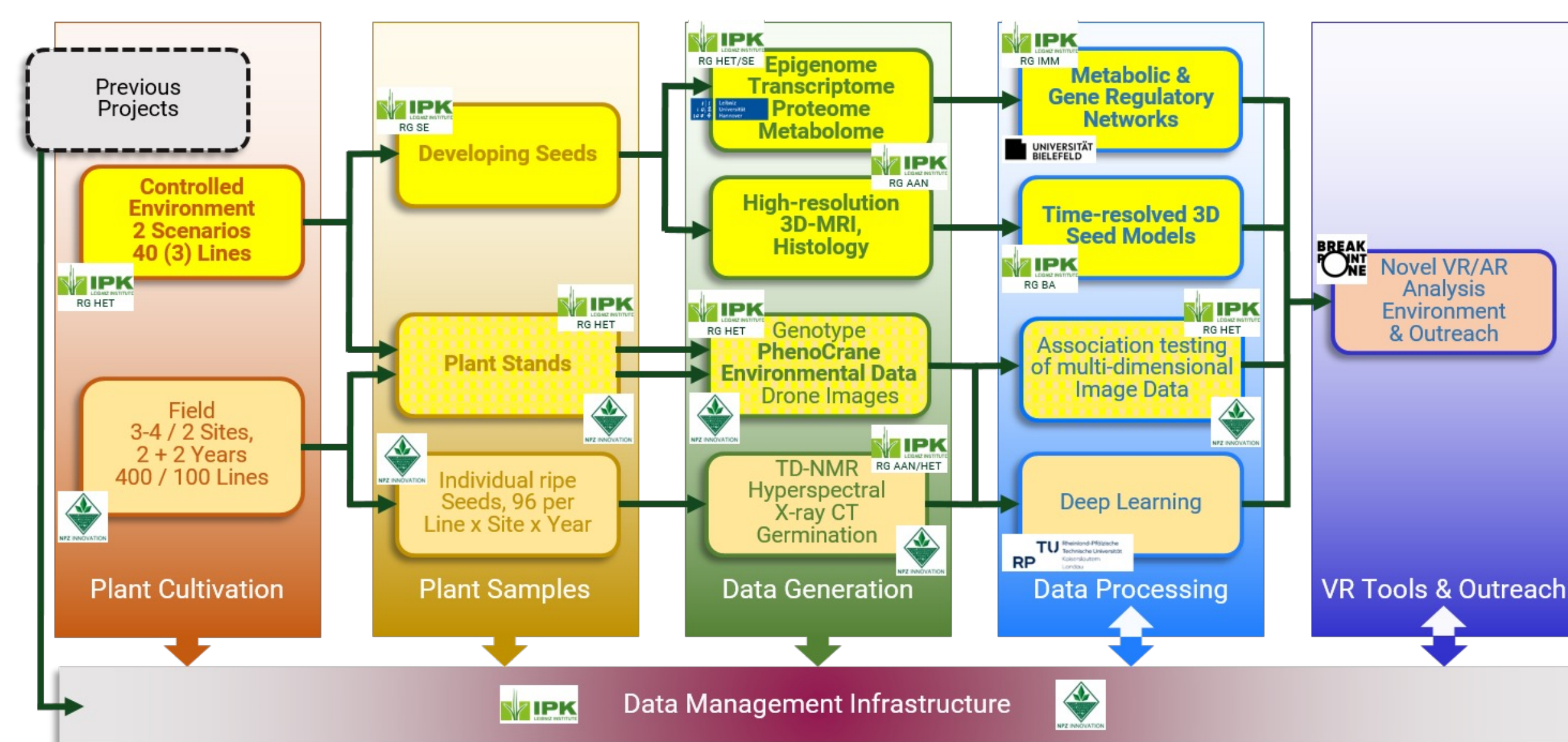
- Time resolved virtual 3D-seed model of rapeseed based on high-resolution MRI, high-throughput X-ray CT and histology
- Interactive display of organ-specific transcriptome, proteome, metabolome data, as well as epigenetic information
- Inferred metabolic and regulatory networks for improved understanding of seed development and trait expression
- Deep learning algorithms for the prediction of seed (quality) traits from ultra-HTP single seed data
- User group-specific education, training, and outreach modules.



Partners & Workflow



- IPK
 - Thomas Altmann (project leader, RG HET), growth & phenotyping in controlled environment, epigenetics
 - Ljudmila Borisjuk (RG AAN), MRI & histology, metabolome, respiration germination assay
 - Jozefus Schippers (RG SE), RNA-seq & tissue sampling
 - Evgeny Gladilin (RG BA), growing seed model & image analysis
 - Mary-Ann Blätke (RG IMM), metabolic networks
 - Matthias Lange (RG BIT), informatics infrastructure
- NPZ Innovation
 - Amine Abadi, breeding nursery, genotyping, X-ray CT, NIRS & Hyperspec, germination
- RPTU Kaiserslautern-Landau
 - Marius Kloft, deep learning
- University Bielefeld
 - Andrea Bräutigam, regulatory networks
- Leibniz University Hannover
 - Hans-Peter Braun, shot-gun proteomics
- Breakpoint One
 - Olaf Sacher & Sebastian Tusk, virtual & augmented reality



Category	2019-20	2020-21	21-22	22-23	Total
CT Images	16,944,725	22,278,394	0	0	39,223,119
CT Images PhenoSphere	---	340,610	0	0	340,610
Drone Images	106,659	70,898	4,095	3,159	184,811
Field Observations	13,156	16,971	2,574	936	33,637
Germination Tests	135,040	162,768	0	0	297,808
Germination Tests PhenoSphere	---	2,880	0	0	2,880
Hyperspectral Segmented Images	67,319,602	19,660,869	0	0	86,980,471
Hyperspec Segm Images PhenoSphere	---	863,700	0	0	863,700
Hyperspectral Tray Images	14,170	18,760	1,890	0	34,820
Hyperspectral Tray Images PhenoSphere	---	300	0	0	300
Seedbag Images (multiple seed images)	1,312	1,802	702	0	3,816
Seedbag Images PhenoSphere	---	300	0	0	300
TD-NMR Measurements	42,510	56,280	7,740	0	106,530
TD-NMR Measurements PhenoSphere	---	900	0	0	900
mRNA-Seq Data Sets PhenoSphere	---	105	105	0	210
TOTAL	37592804	12789651	6318	0	131,073,612

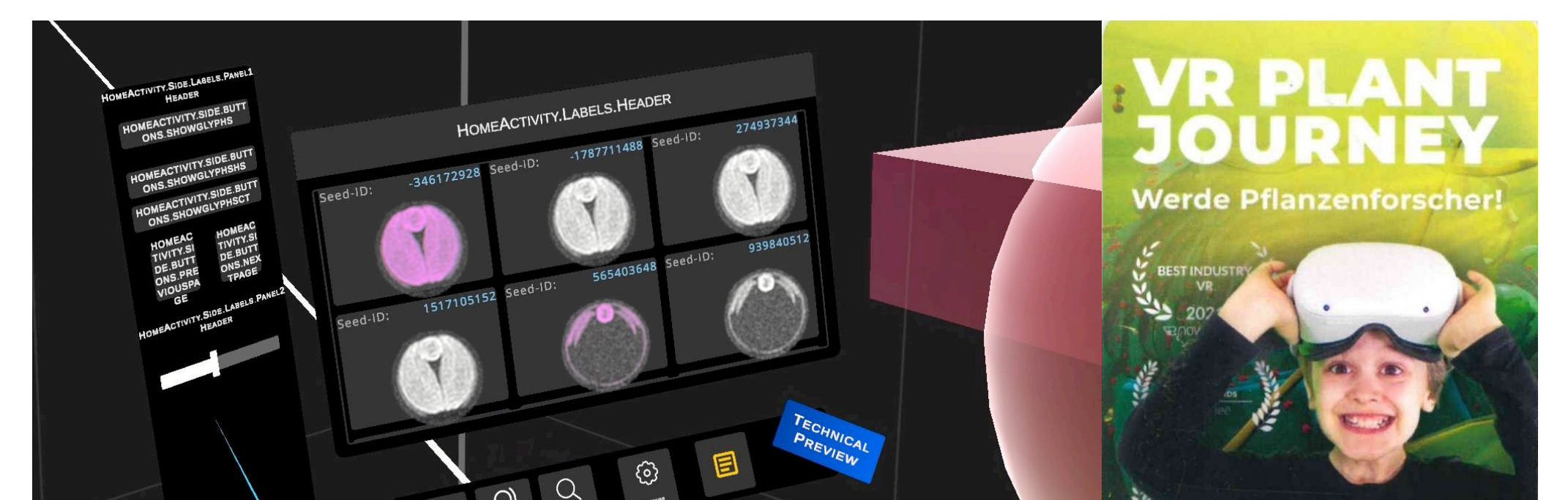
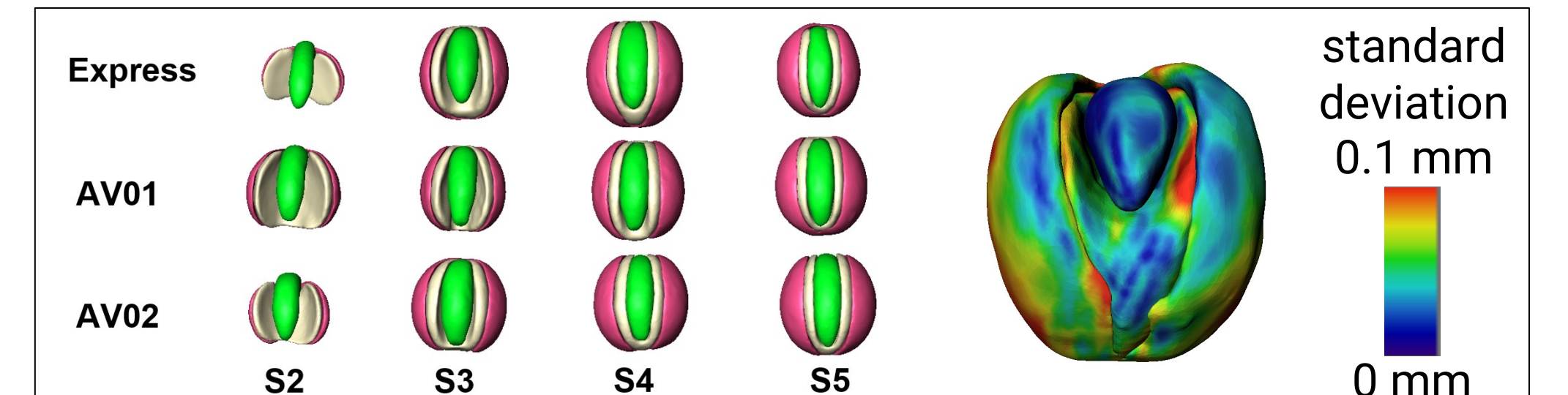
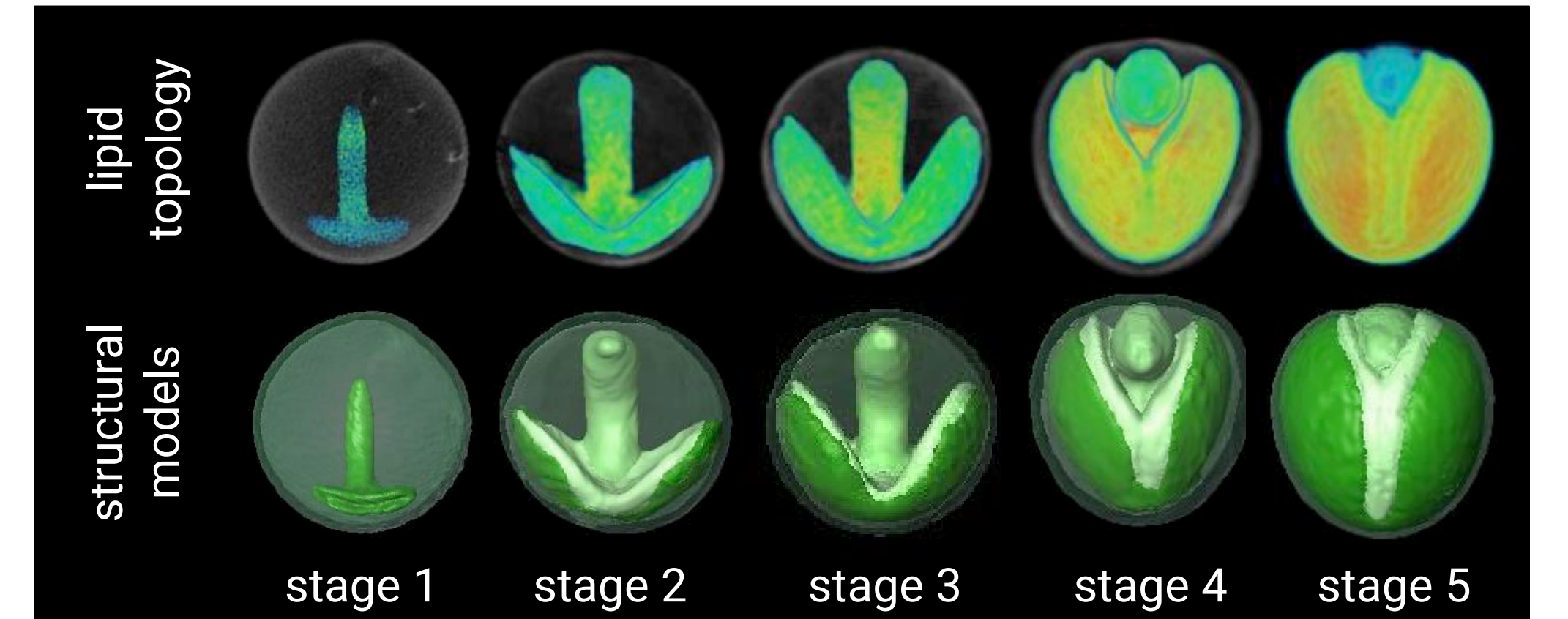
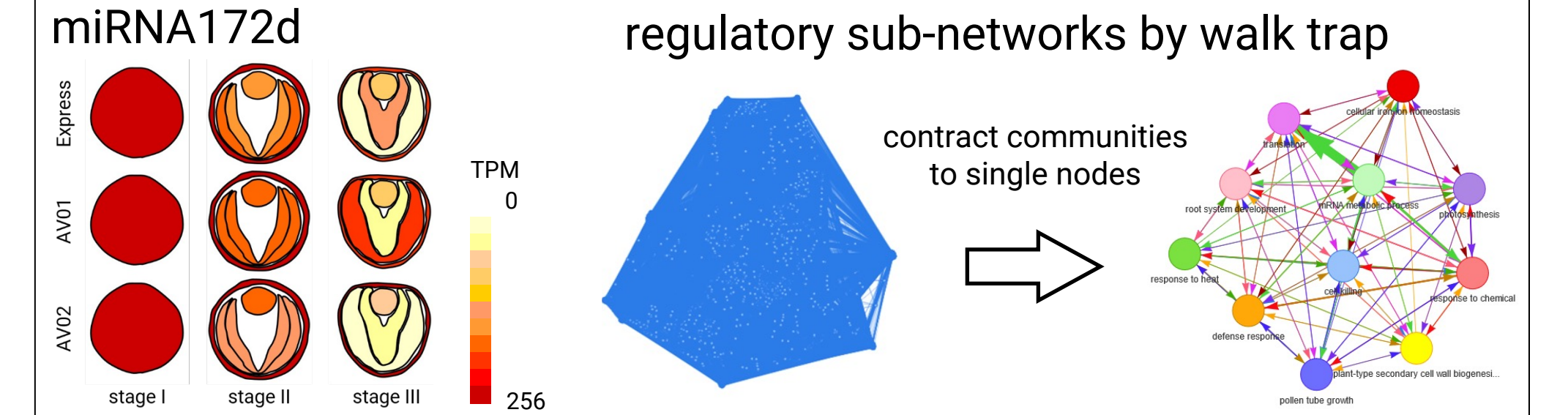
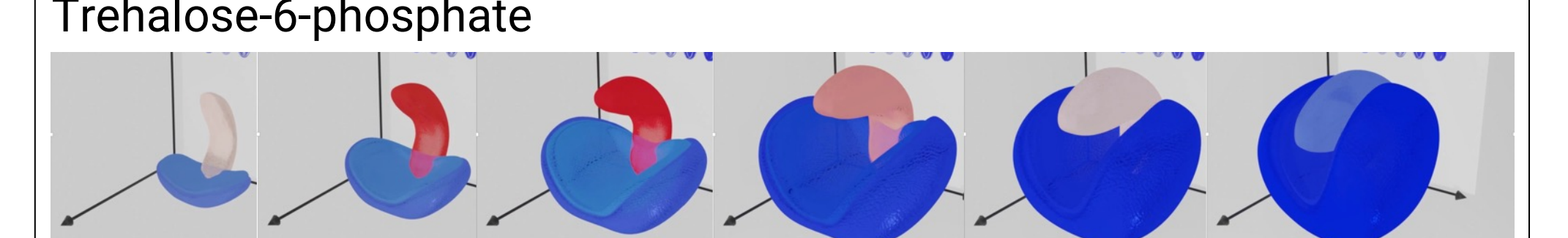
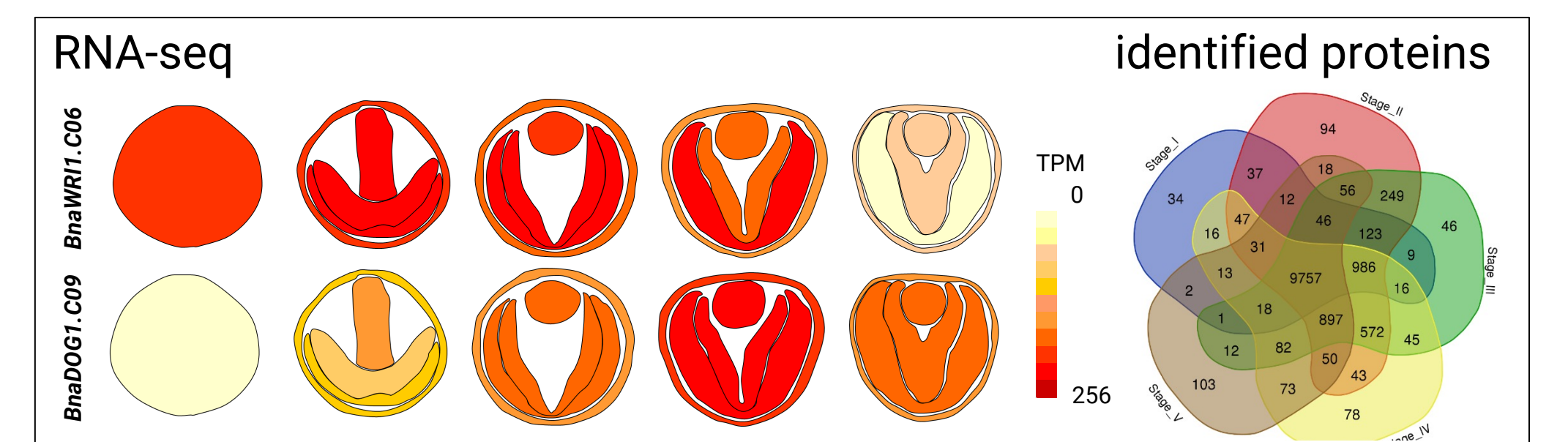
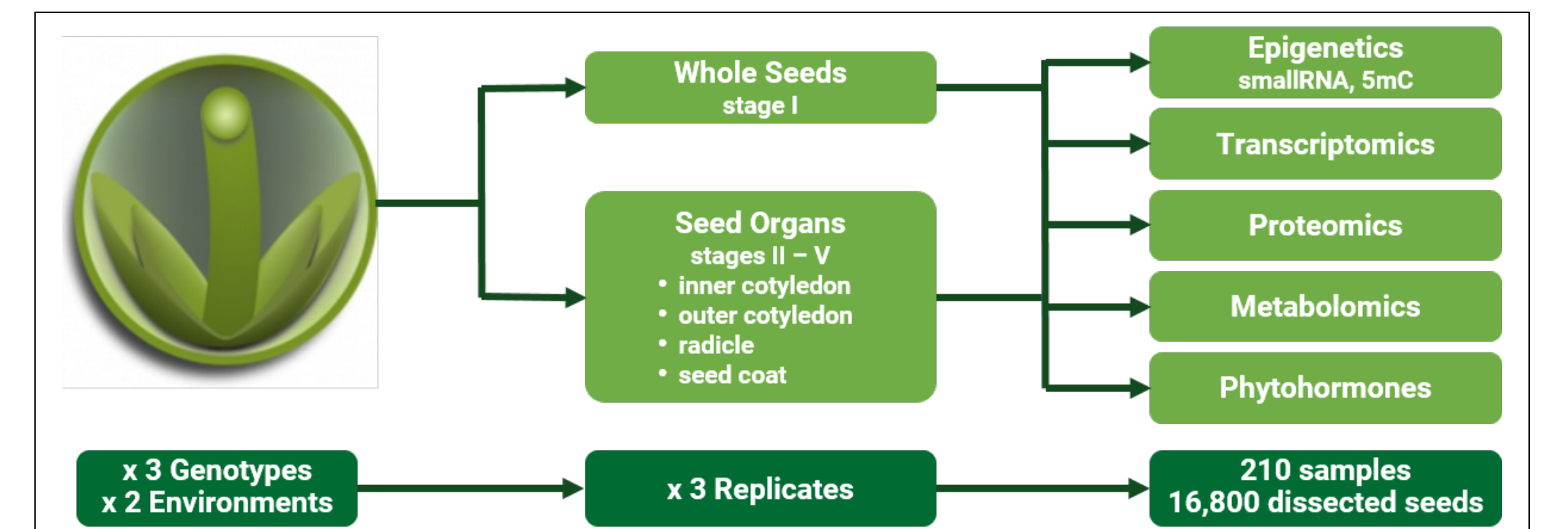
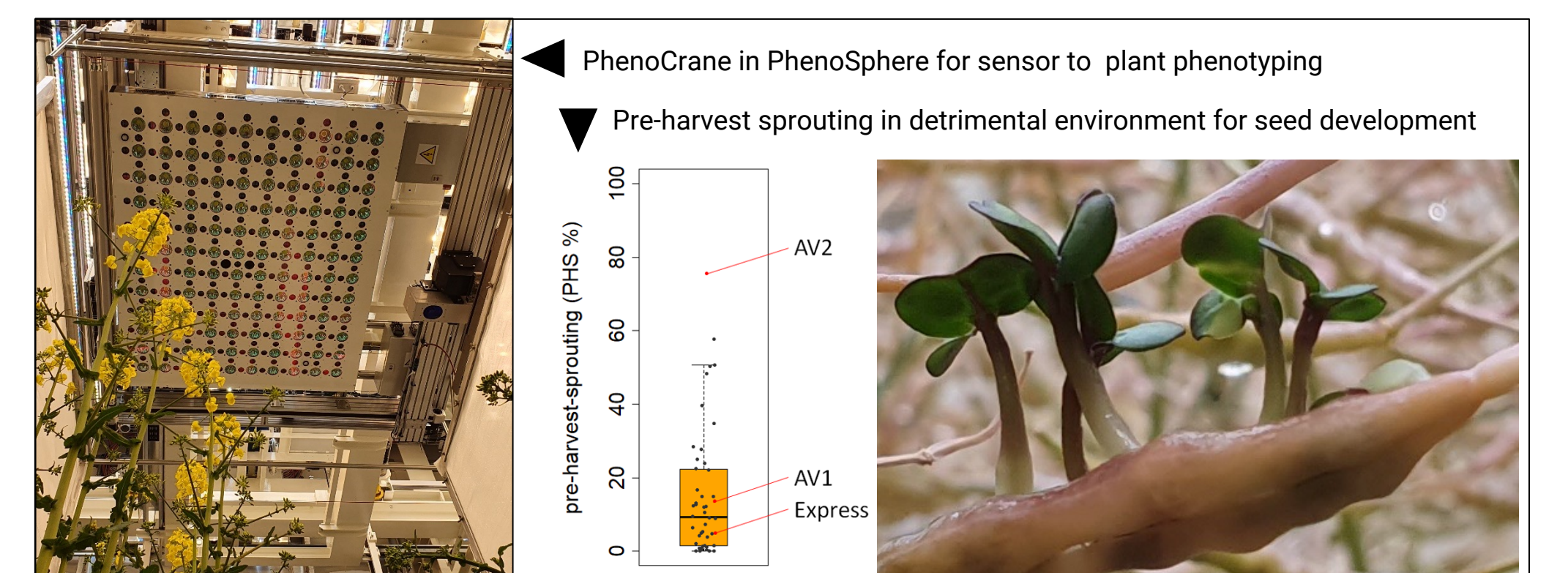
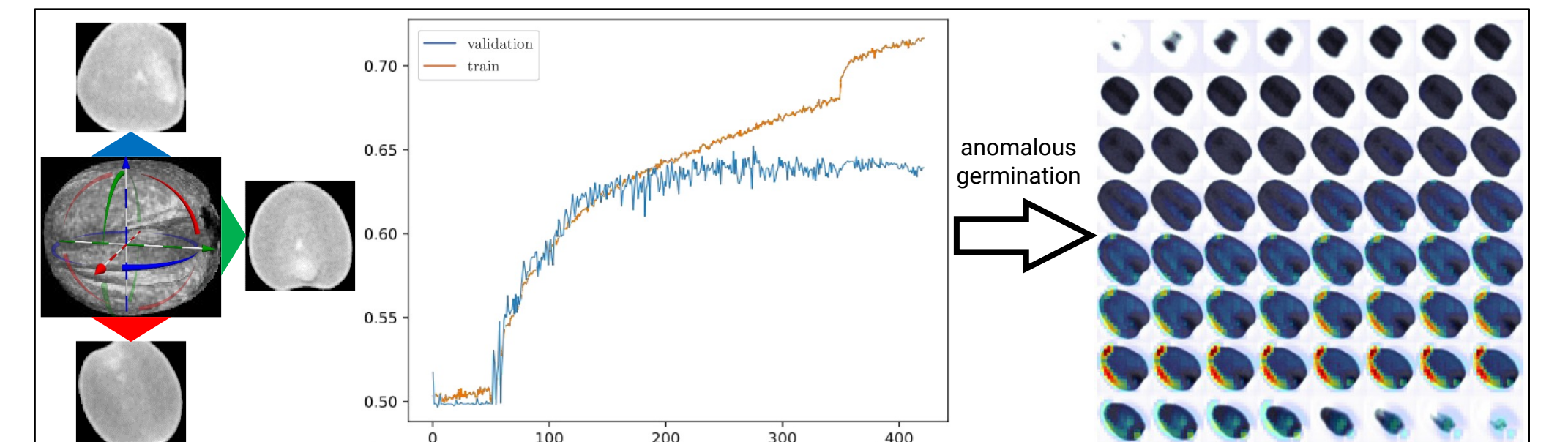
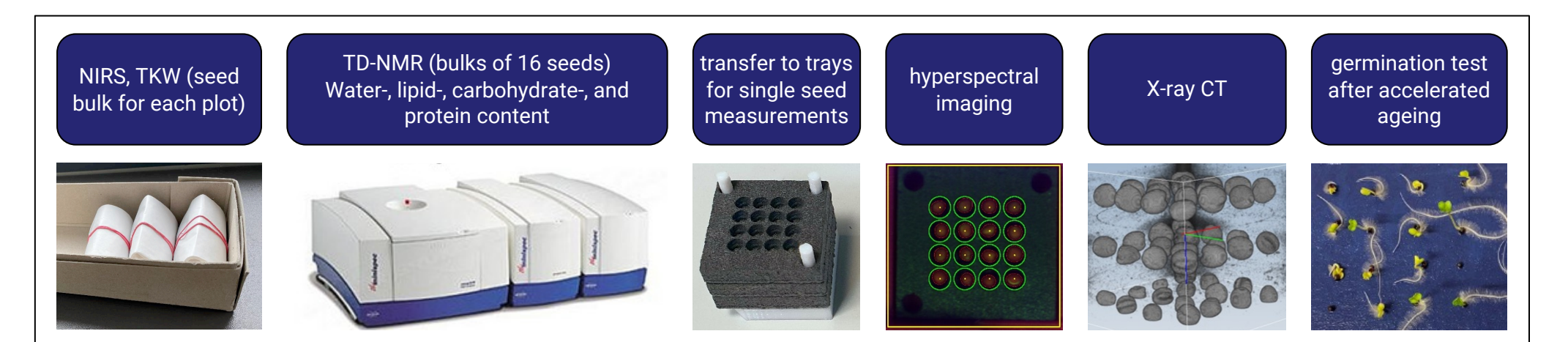
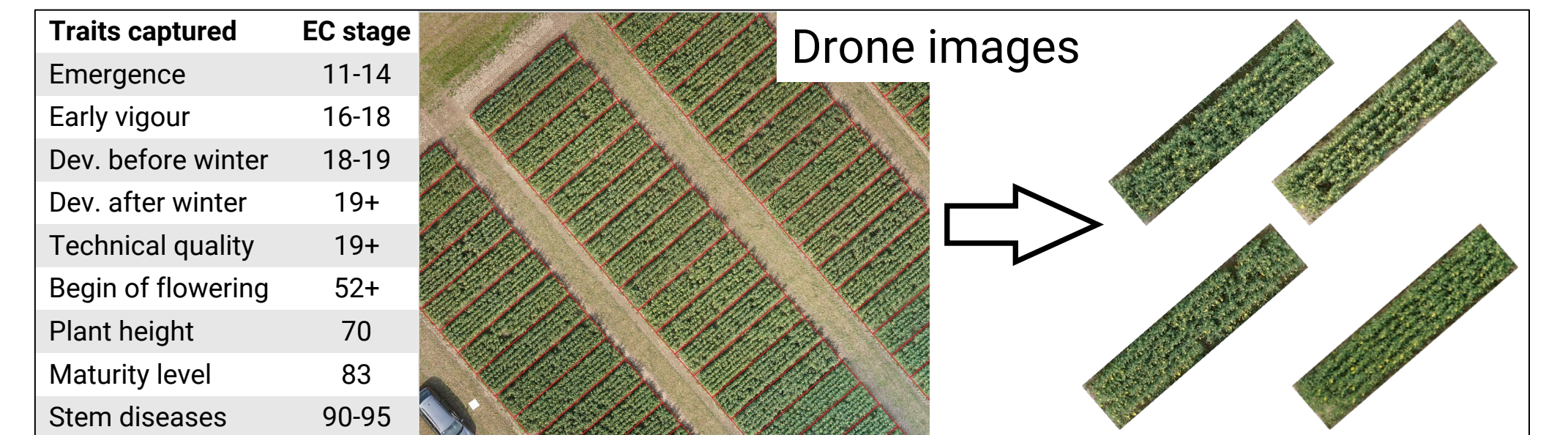
Quick Facts

Funding: BMBF from 01.06.2019 to 30.09.2024
 Funding total: 7.2 million €, IPK: 4.4 million €
 Coordination: Prof. Dr. T. Altmann (IPK, RG HET)
 Website and Data Portal: www.avatars-project.de



Achievements

HT single field phenotyping
 deep learning seed analysis
 fully controlled environment
 tissue sampling for multi-omics
 multi-omics and regulatory networks
 MRI of single seeds
 3D seed models
 VR visualisation



NETWORK