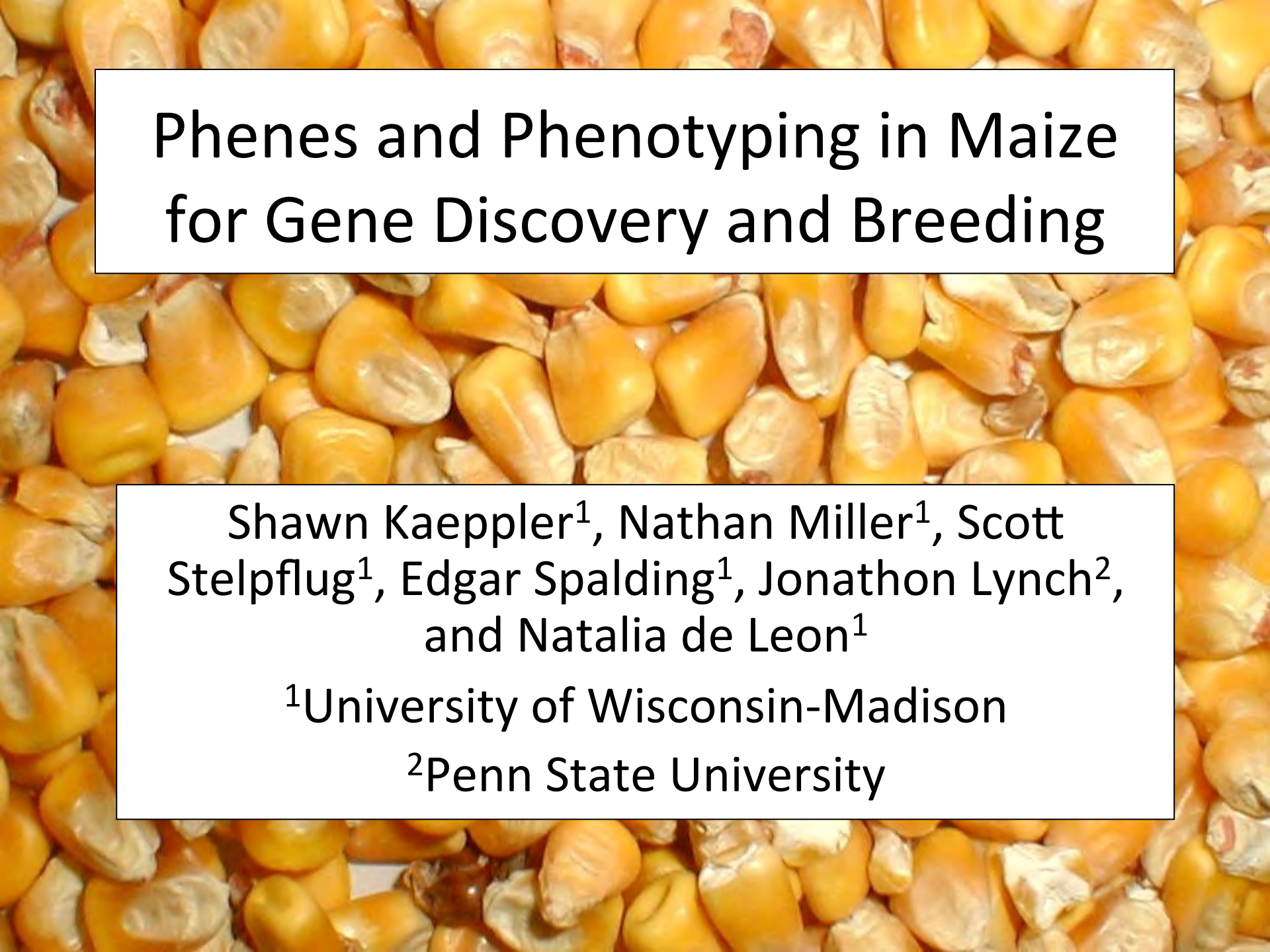


Phenes and Phenotyping

- Sunday January 10, 2016
- 8:18 – 8:36
- Town and Country – Pacific Salon 3



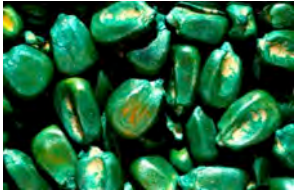
Phenes and Phenotyping in Maize for Gene Discovery and Breeding

Shawn Kaeppler¹, Nathan Miller¹, Scott
Stelpflug¹, Edgar Spalding¹, Jonathon Lynch²,
and Natalia de Leon¹

¹University of Wisconsin-Madison

²Penn State University

Seed to Seed: 600X biomass return



~30 kg seed/ha

~75 days



~12 Mg/ha
vegetative biomass
at flowering

~45 days



~12 Mg/ha
grain



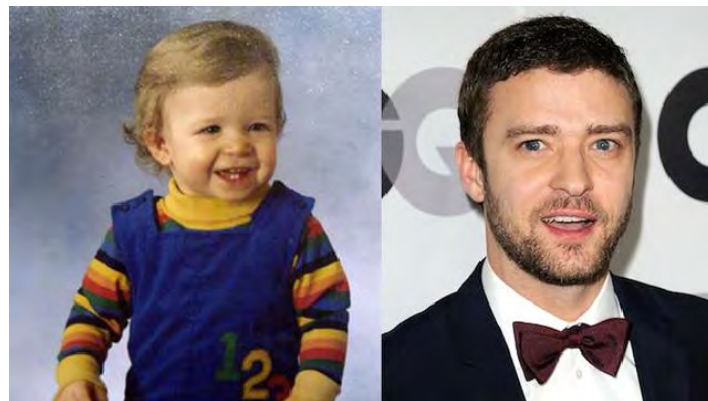






Justin Bieber Born March 1, 1994 (19)

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The challenge of translational research

genome



phenome

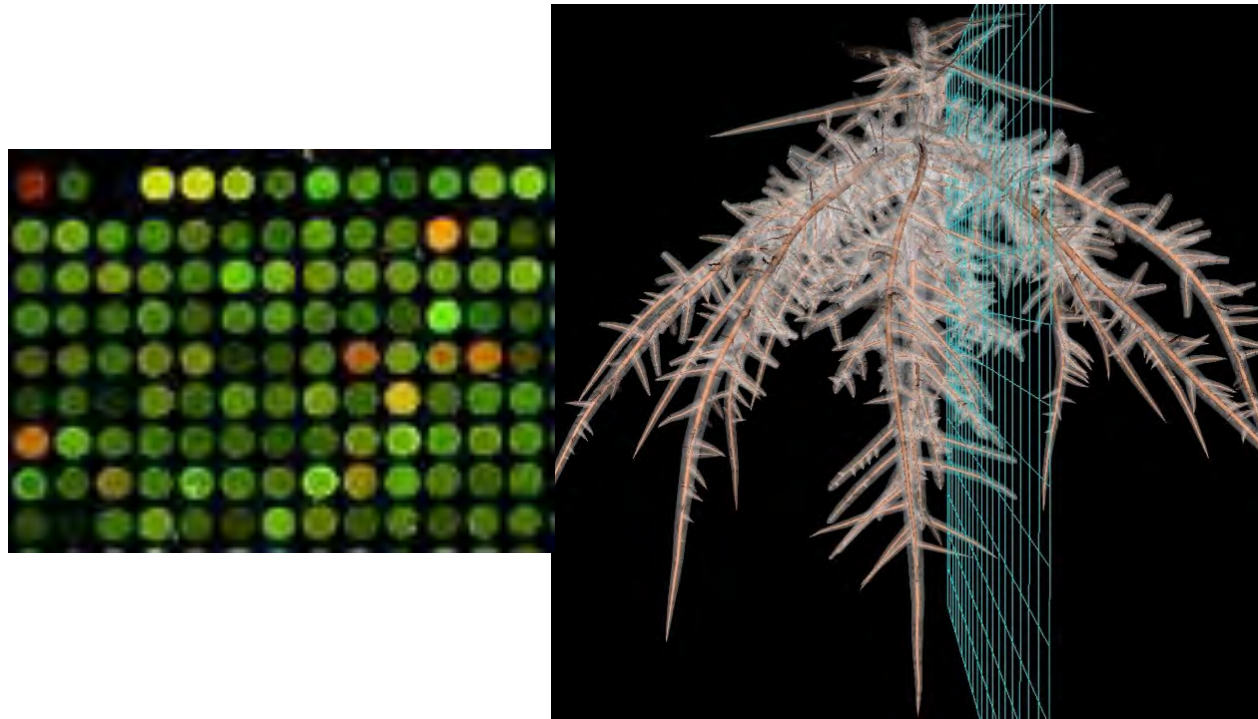


agronome

which genes?
regulation?
interactions?

which traits?
costs & benefits?
tradeoffs?
integrated
phenotypes

productivity?
resource use?
species interactions
sustainability?
equity?



Potential Benefits of Phenotyping:

Identifying traits early in development
that indicate final potential



Day 1

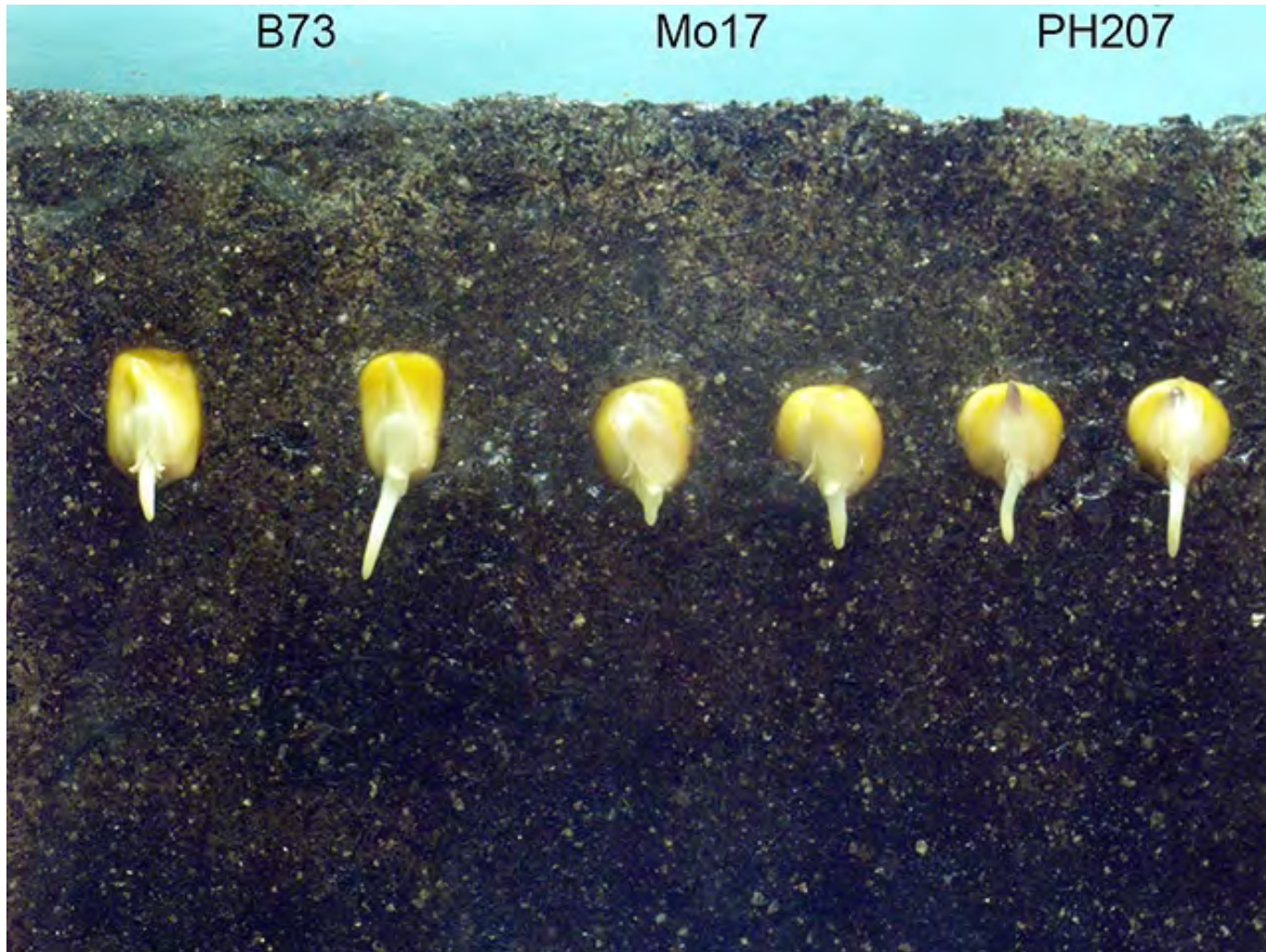
Day 2

Day 3

Day 4

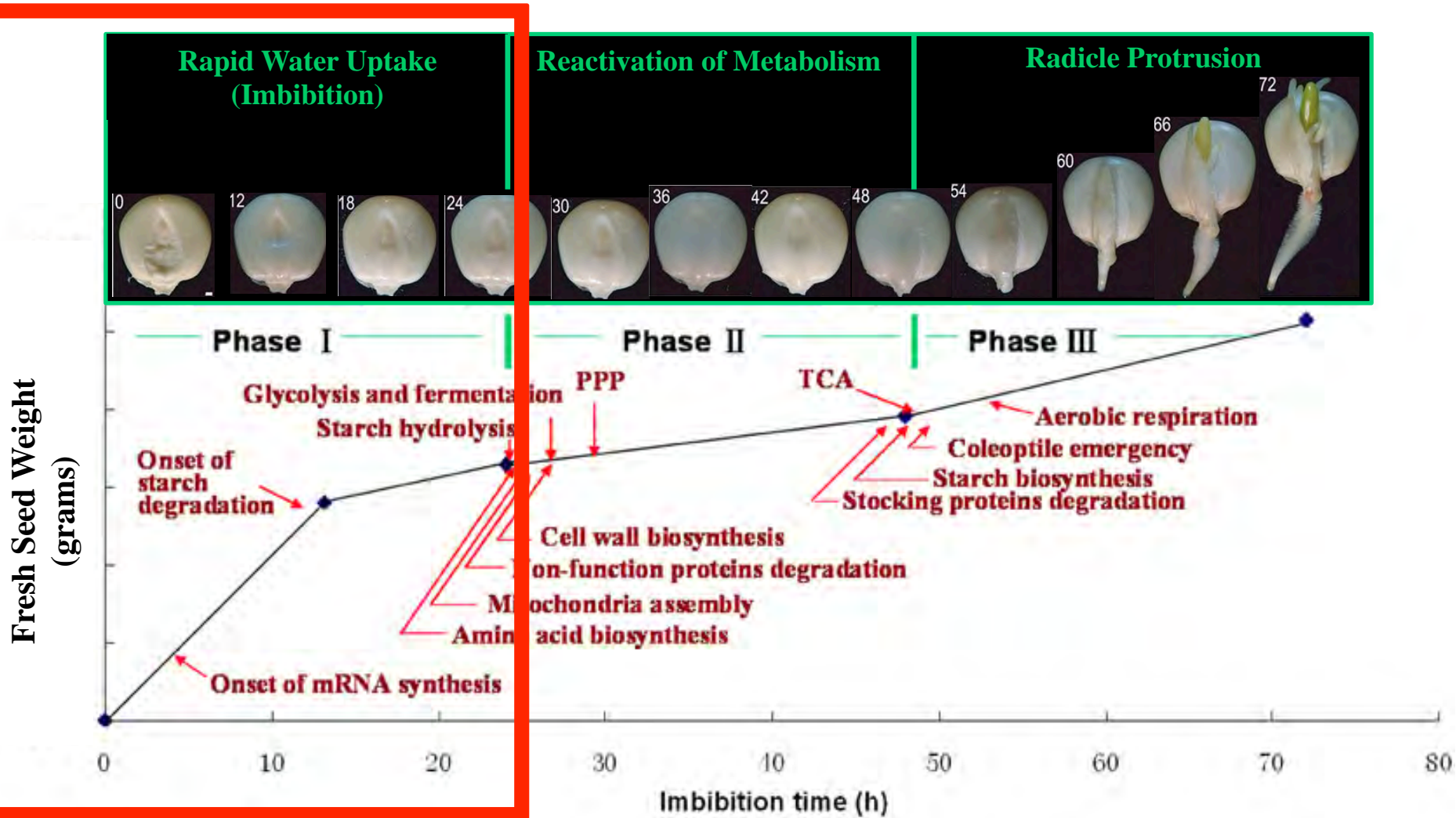
Day 5

Maize Diversity

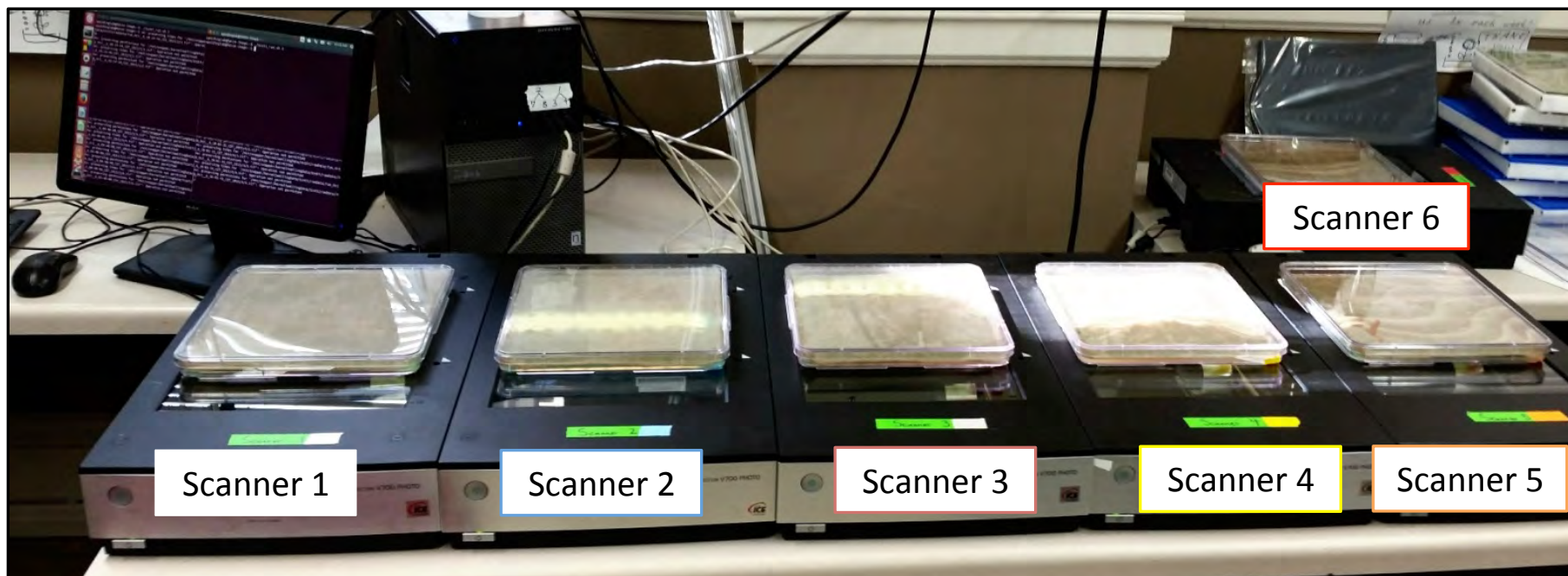
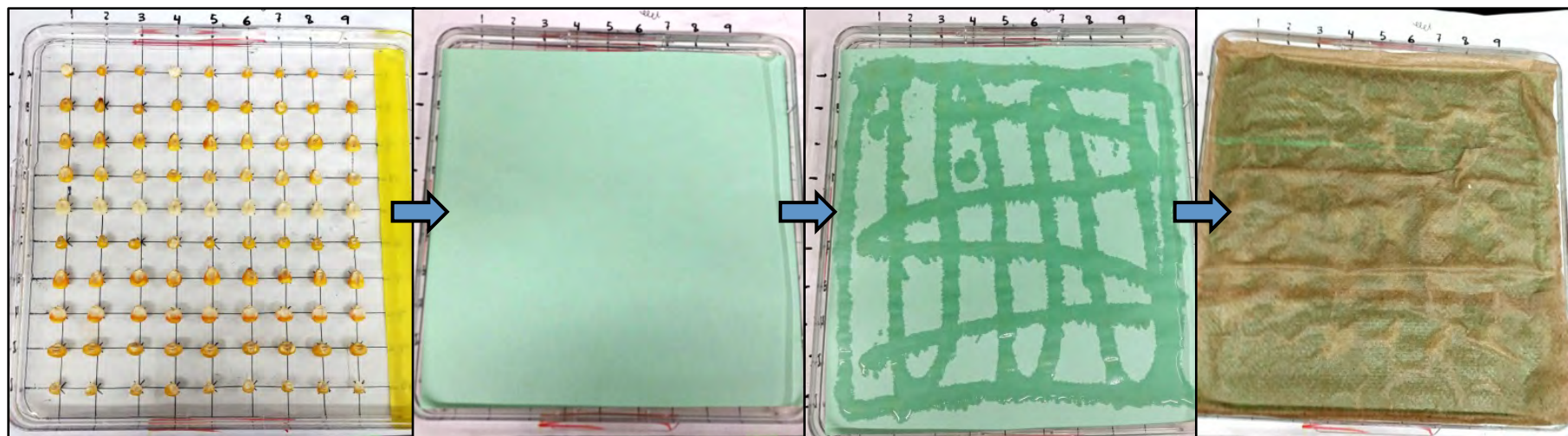


Video by Edgar Spalding

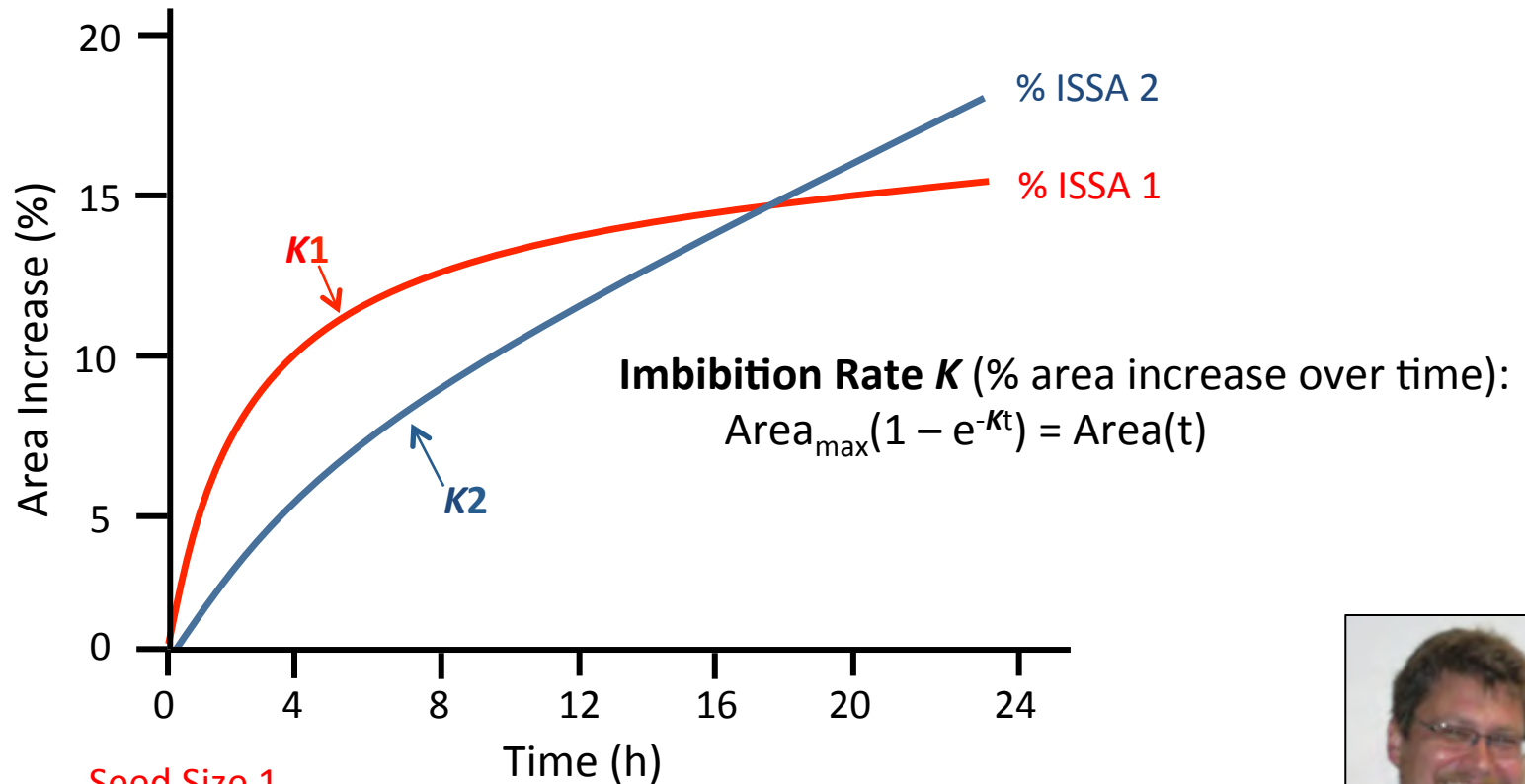
THE TRIPHASIC MODEL OF GERMINATION



PHENOTYPING PLATFORM

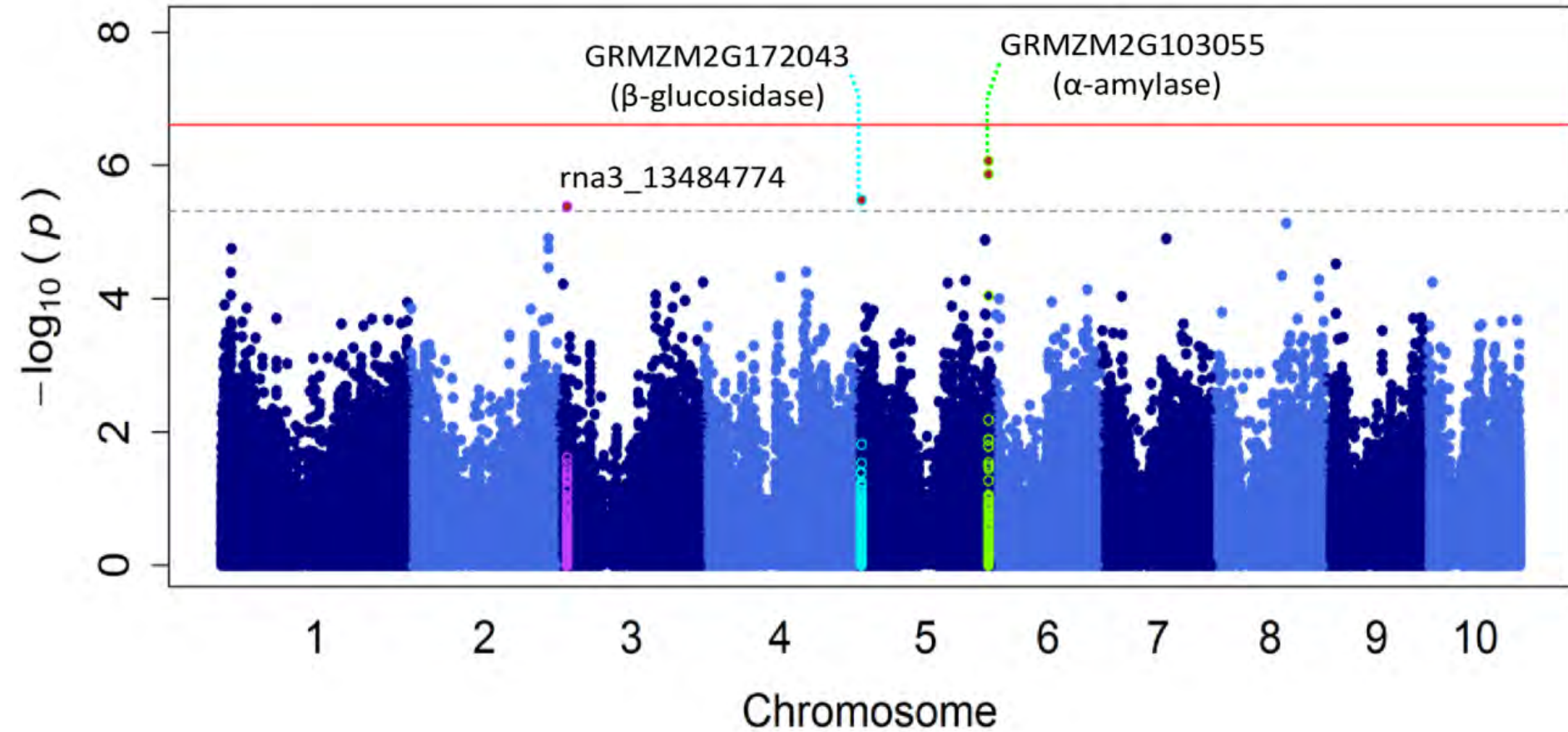


Example Schematic of Measured Seed Imbibition Phenotypes

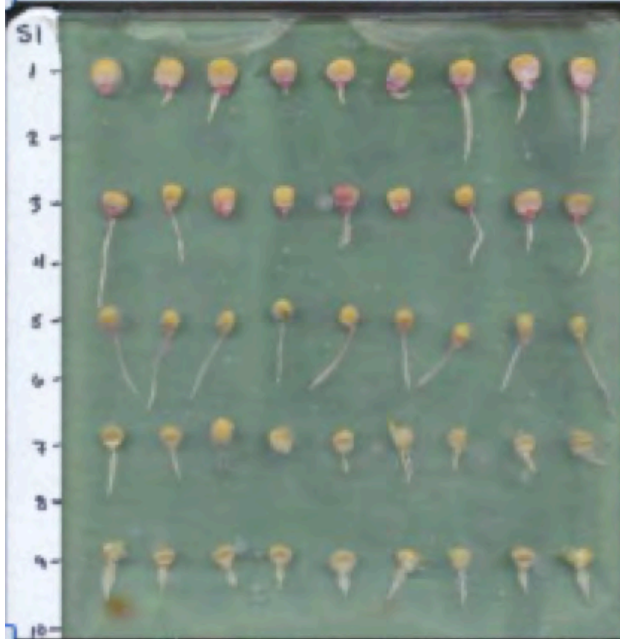


Nathan Miller
Spalding Lab

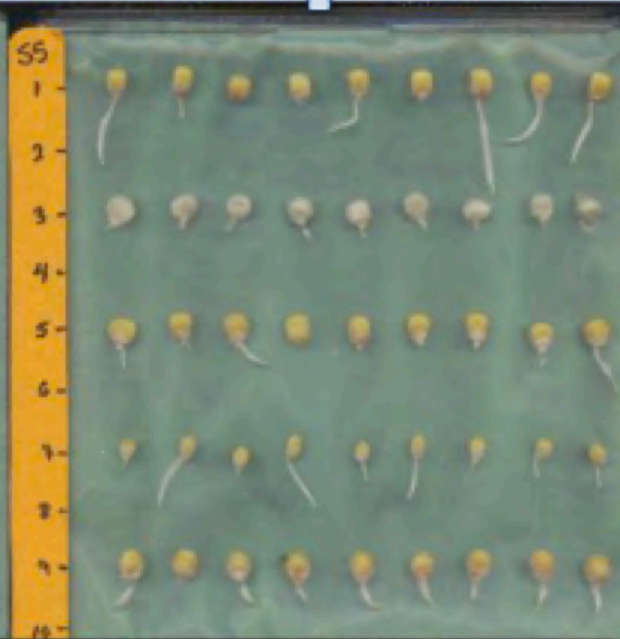
Imbibition Rate K – GWAS



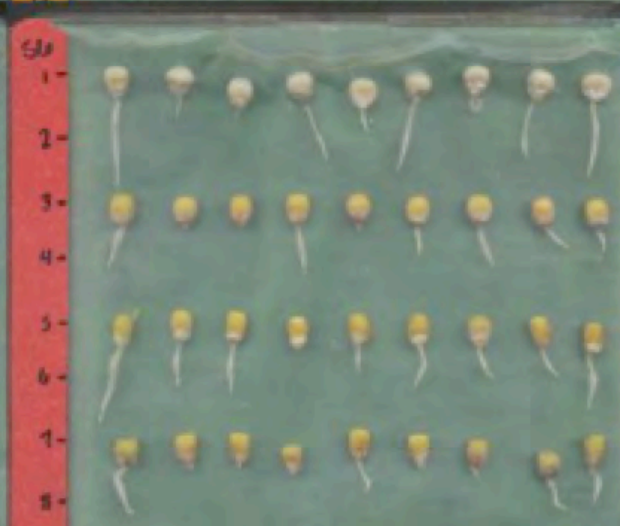
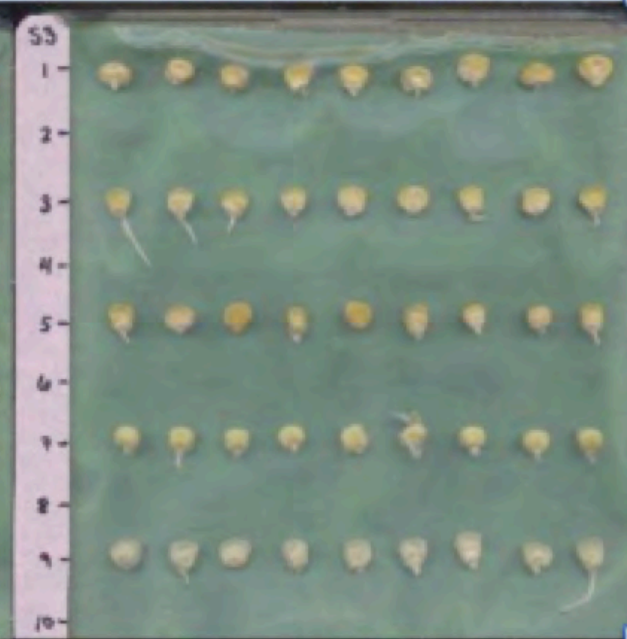
FAST SWELLERS



MEDIUM SWELLERS



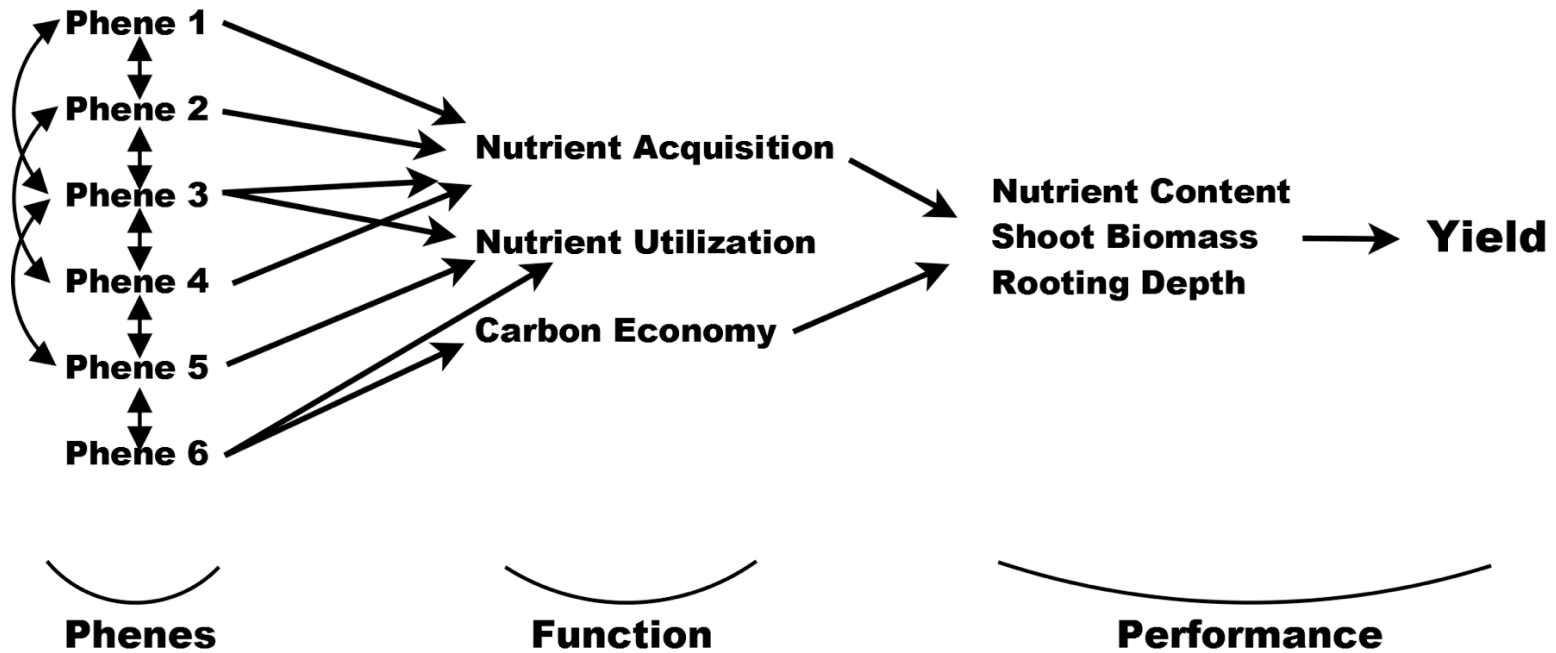
SLOW SWELLERS



Potential Benefits of Phenotyping:

Identification of novel elemental phenes using unique technologies

what is a phene?



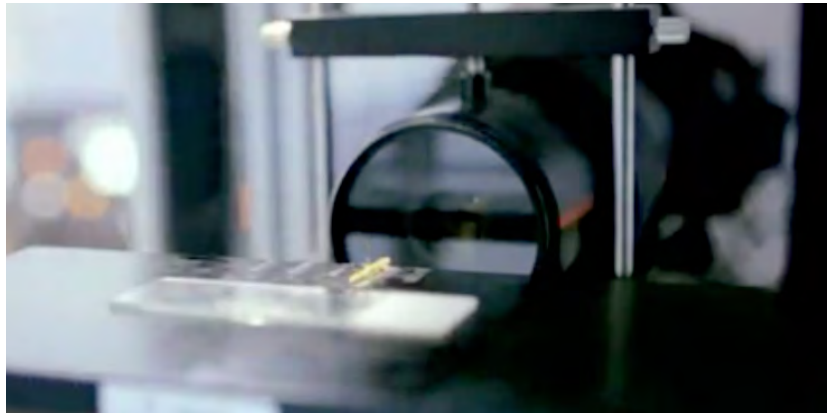
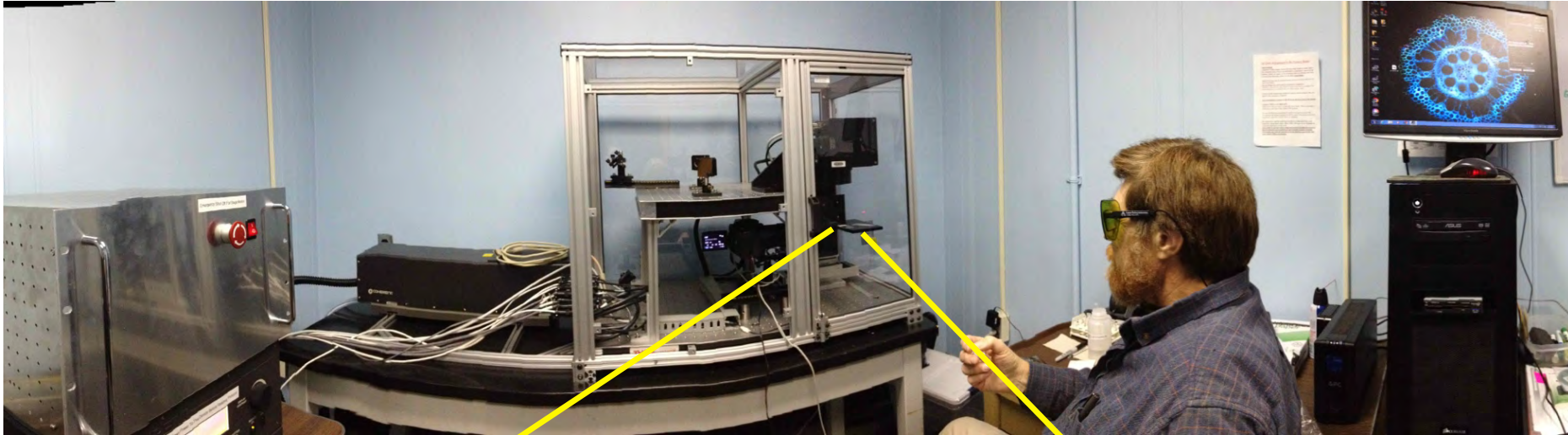
Shovelomics

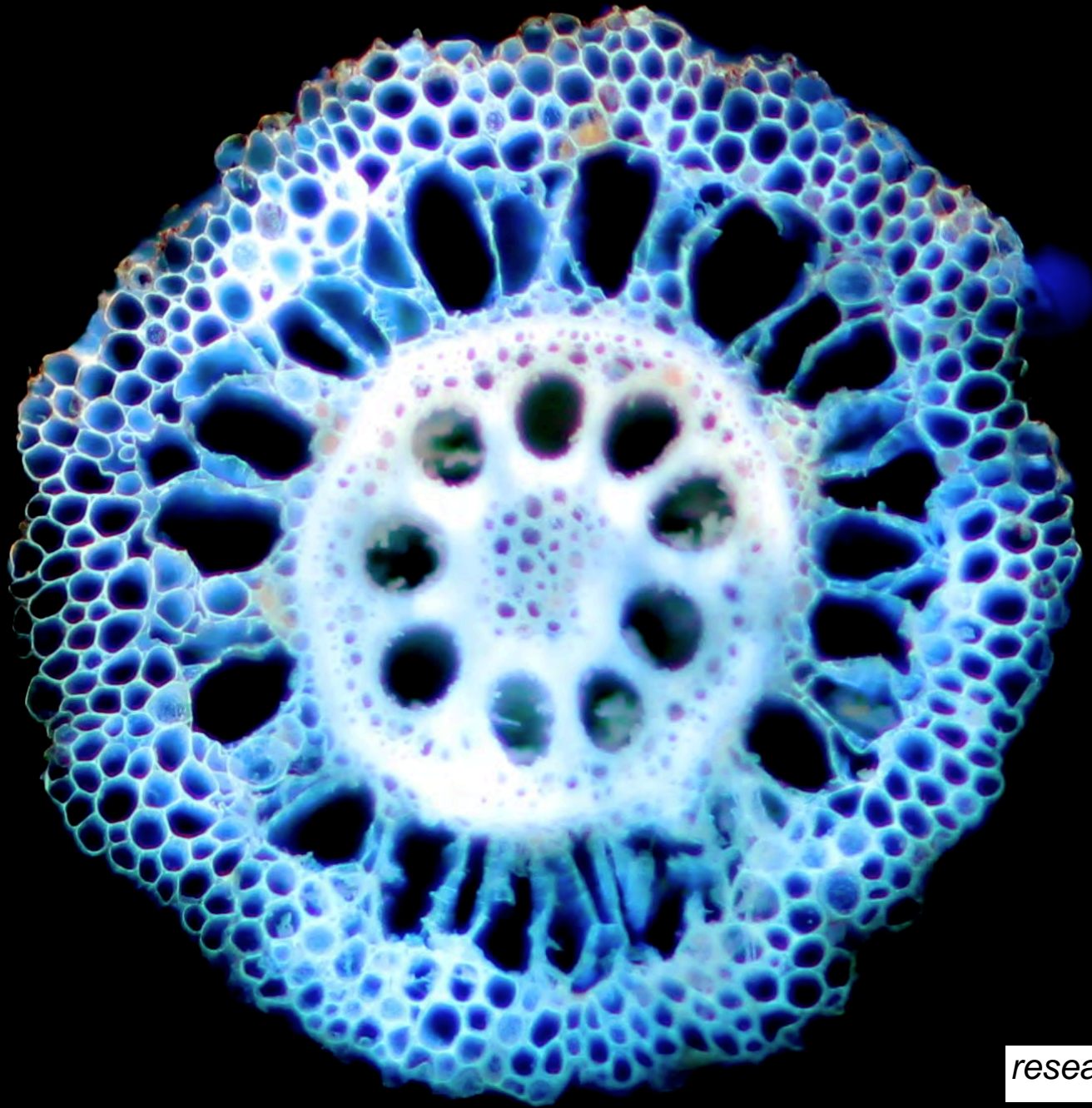
high throughput
phenotyping of root
architecture in the field

2 min/genotype

25,000 plots/yr
bean, maize, sorghum,
cowpea, groundnut, barley







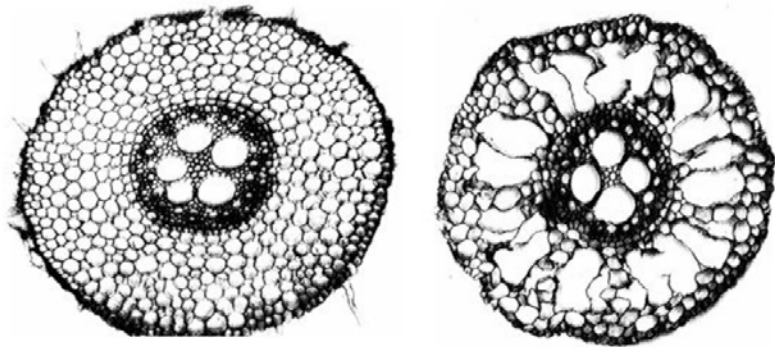
research of Ben Hall

High RCA improves yield under drought



Under water stress in field studies in the USA and greenhouse mesocosms, high RCA lines had

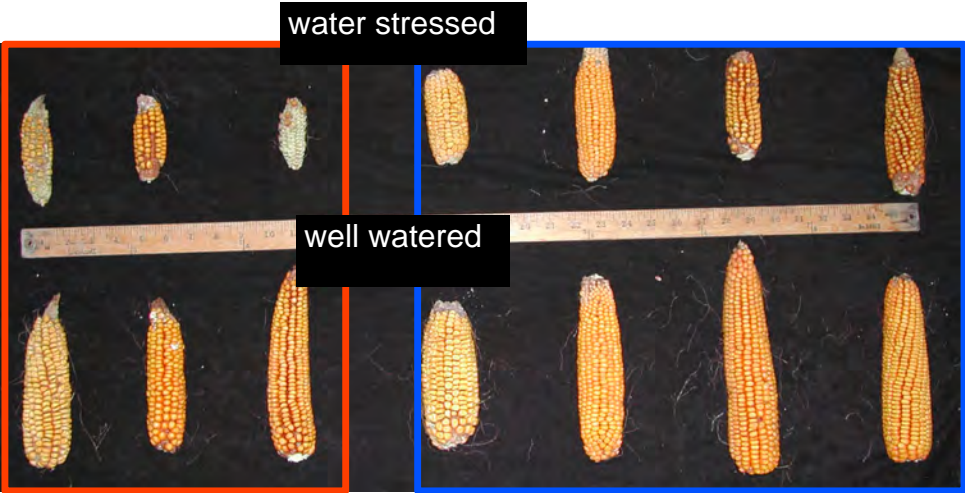
- 55% less specific root respiration
- 340% more roots 40-50 cm deep
- 10% greater leaf RWC
- 43% better growth
- 800% more yield



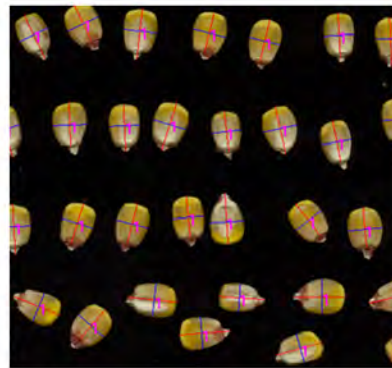
Seminal root sections of RILs of Oh43xW64A differing in RCA

RILs with less RCA

RILs with more RCA



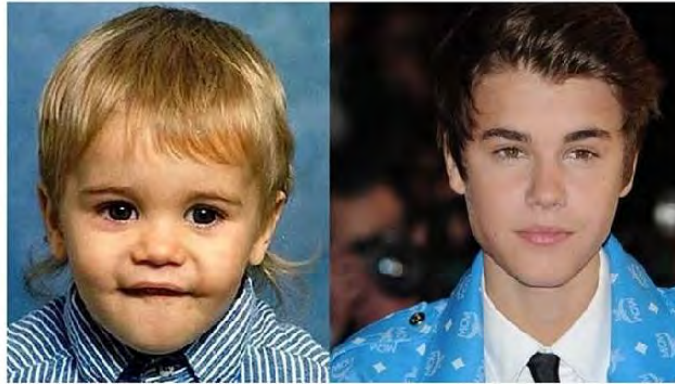
Advances in computation, imaging, detection, and robotics and nanotechnology make many measurements possible



Major and minor axes measured for each kernel (above).
Fourier transform of the ear (left) measured the average kernel length in the axial direction.
Together, these two measurement modes determine the three principal dimensions of the average kernel on an ear.

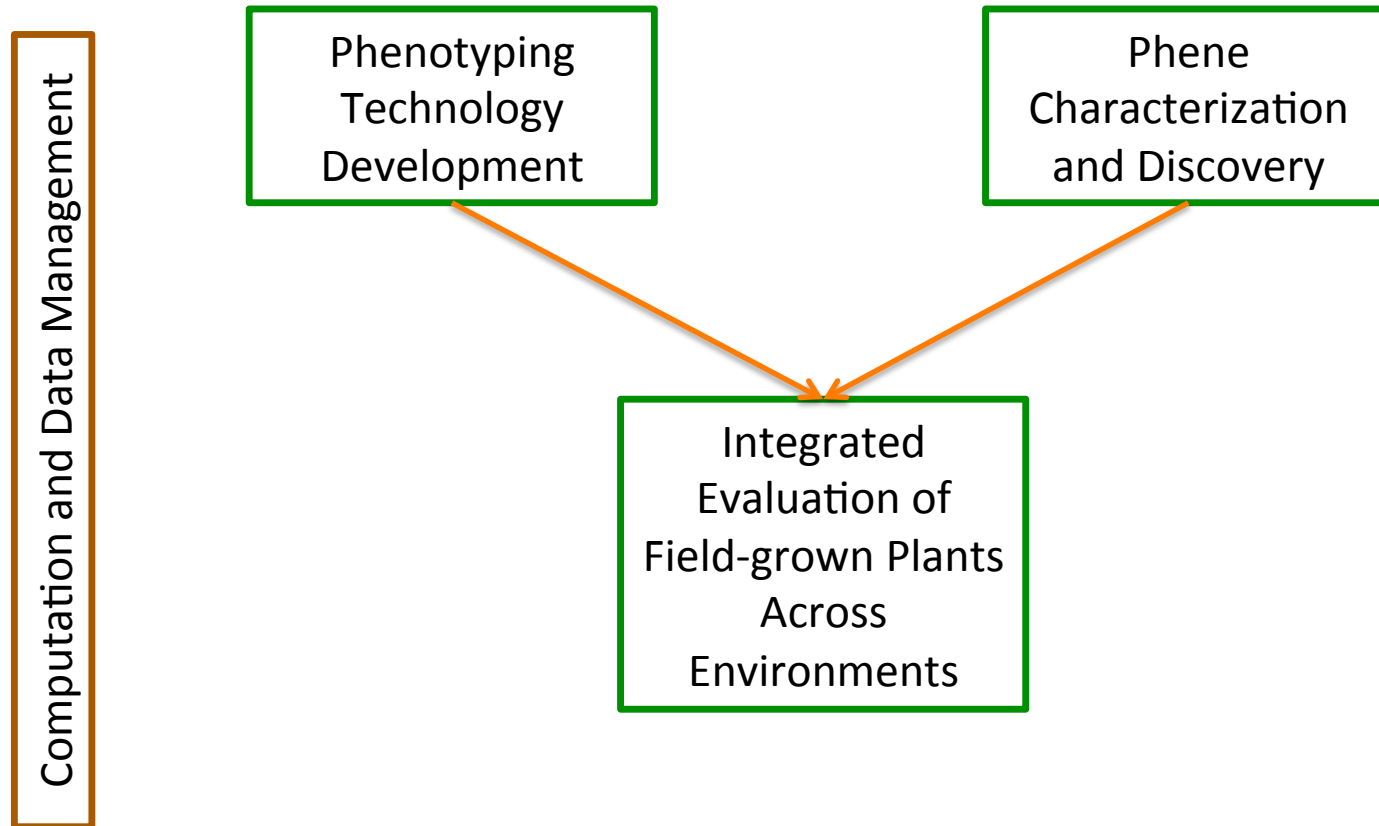


The challenge is to determine which measurements are valuable

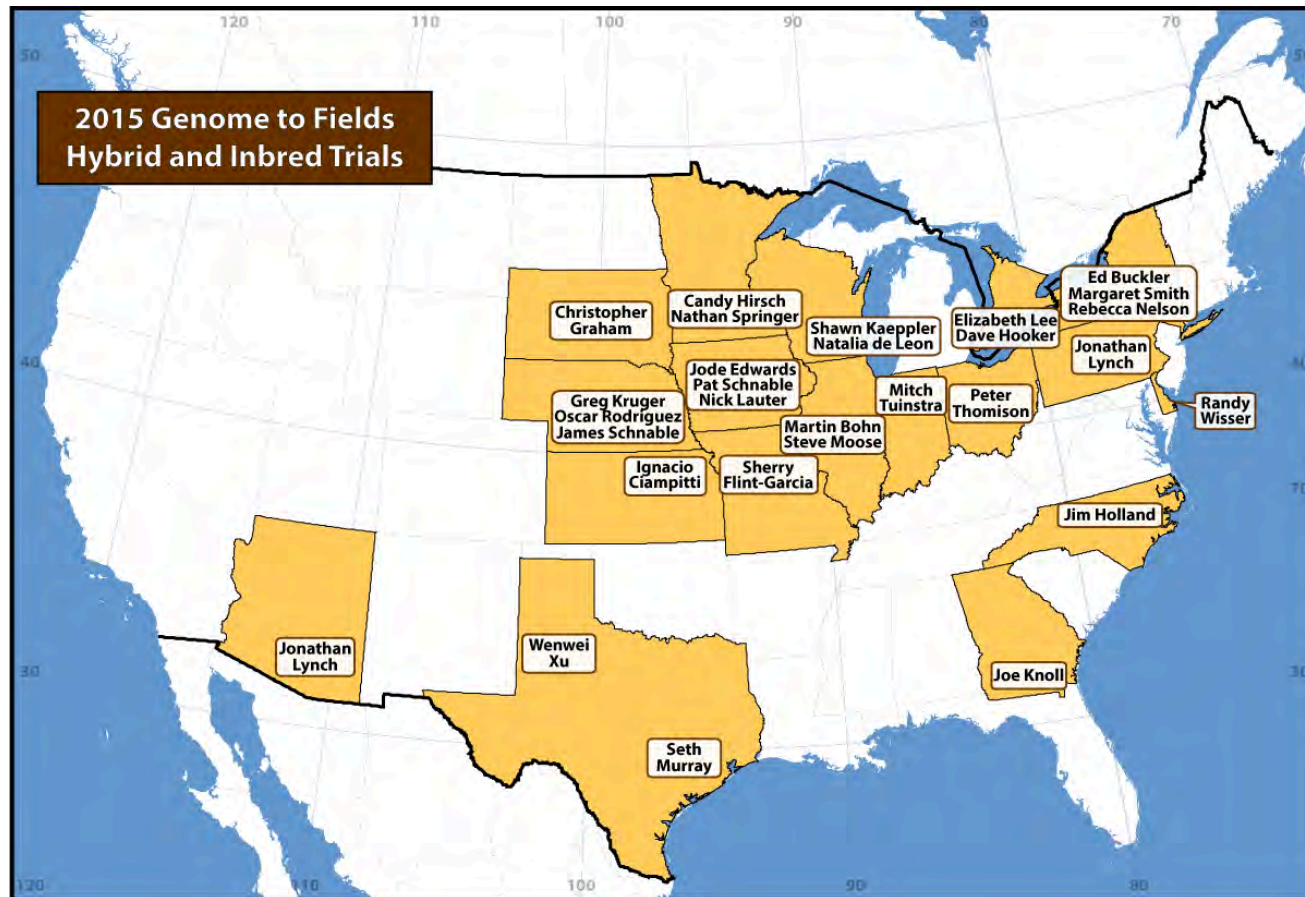


Justin Bieber Born March 1, 1994 (19)

The challenge is to determine which measurements are valuable



Genomes to Fields



Acknowledgements



Questions?

