BrAPI and High-Dimensional Phenotypes

Lauren Brzozowski, Jenna Hershberger, Jean-Luc Jannink, Nicolas Morales, Lukas Mueller, Alex Ogbonna, Peter Selby, Adrian Powell

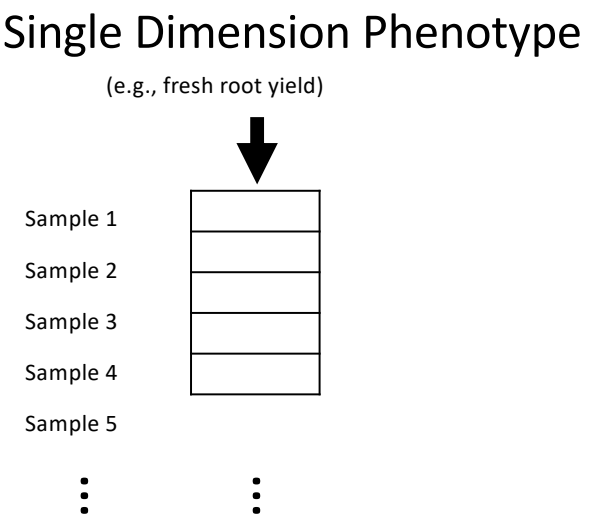
BrAPI Hackathon – April 25-29, 2022

BREEDBASE

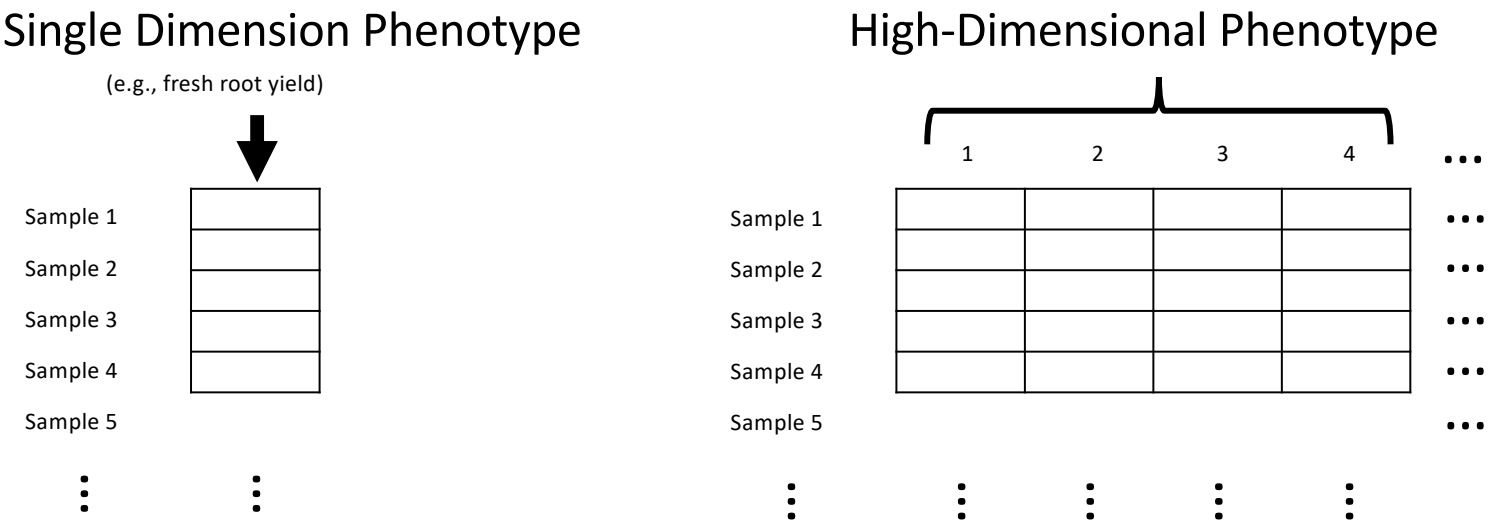
BTI Discovery & Innovation in the Life Sciences

BOYCE THOMPSON INSTITUTE

High-Dimensional Phenotypes



High-Dimensional Phenotypes



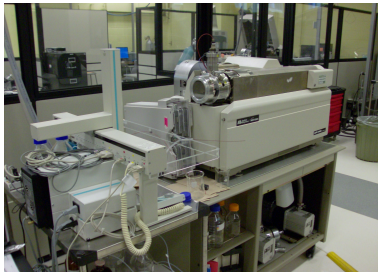
High-Dimensional Phenotypes

Transcriptomics

Illumina

	Gene 1	Gene 2	Gene 3	Gene 4	⋯
Sample 1					⋯
Sample 2					⋯
Sample 3					⋯
Sample 4					⋯
Sample 5					⋯
⋮	⋮	⋮	⋮	⋮	

Metabolomics



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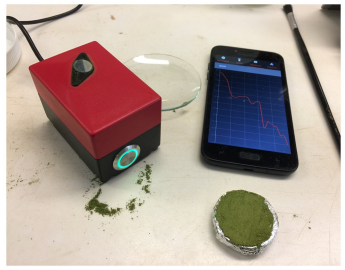
NIRS



Prananto et al., 2021

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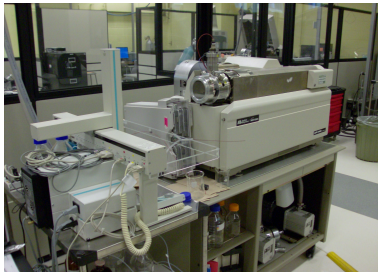

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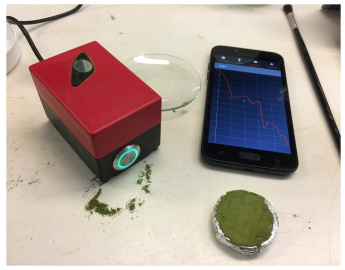

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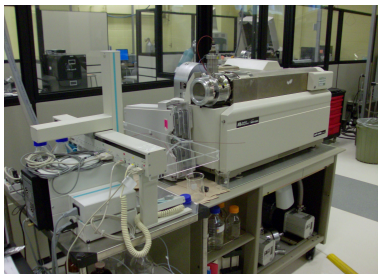

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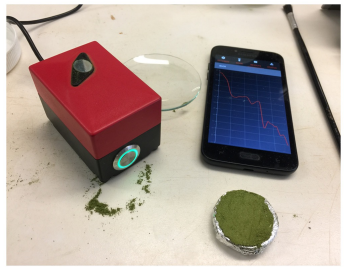

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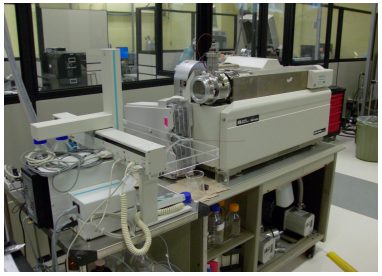

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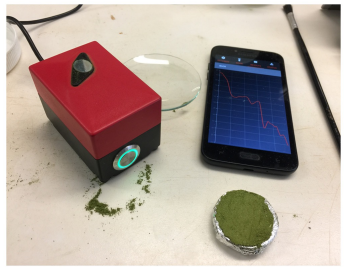

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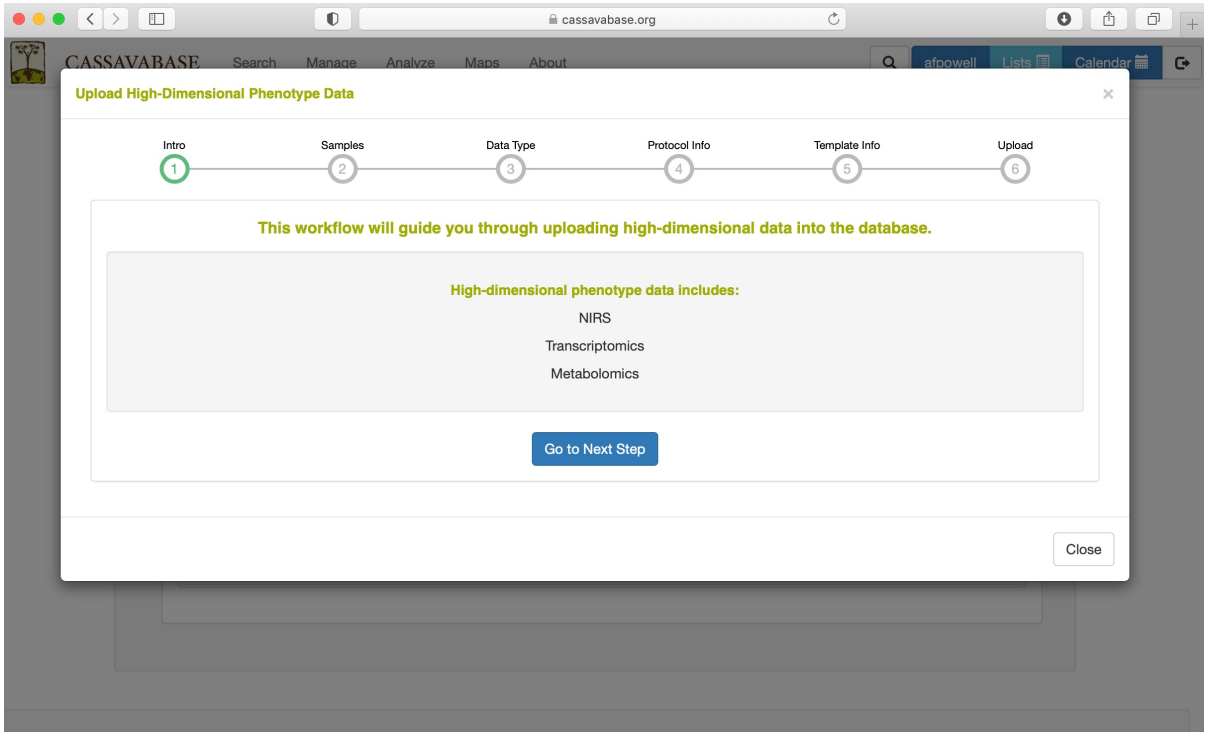
High-Dimensional Phenotypes: Breedbase Upload and Storage



High-Dimensional Phenotypes: BrAPI Calls

Protocol Metadata

GET https://test-server.brapi.org/brapi/v2/nirs/id
GET https://test-server.brapi.org/brapi/v2/transcriptomics/id
GET https://test-server.brapi.org/brapi/v2/metabolomics/id

Data Matrices

GET https://test-server.brapi.org/brapi/v2/nirs/id/matrix
GET https://test-server.brapi.org/brapi/v2/transcriptomics/id/matrix
GET https://test-server.brapi.org/brapi/v2/metabolomics/id/matrix

GET https://test-server.brapi.org/brapi/v2/nirs
GET https://test-server.brapi.org/brapi/v2/nirs?observationunitDbId=abcxyz
GET https://test-server.brapi.org/brapi/v2/nirs/id/matrix?studyDbId=123

High-Dimensional Phenotypes: BrAPI Calls

Data Matrix

For each ‘row’:

- Observation Unit DbID
- Observation Unit Name
- Tissue Type
- Data Values
- …

High-Dimensional Phenotypes: BrAPI Calls

Transcriptomics Protocol Metadata

- Header Column Names
- Header Column Details
  - Gene ID
  - Chromosome
  - Start
  - End
  - Gene Description
- Genome Version
- Annotation Version
- Expression Unit

NIRS Protocol Metadata

- Header Column Names
- Device Type

Data Matrix

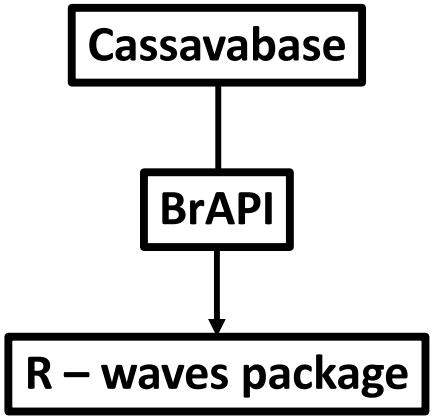
For each 'row':

- Observation Unit DbID
- Observation Unit Name
- Tissue Type
- Data Values
- …

Metabolomics Protocol Metadata

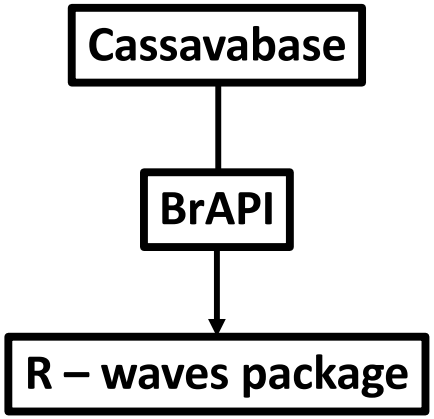
- Header Column Names
- Header Column Details
  - InChI Key
  - Compound Name
- Equipment Type
- Equipment Description
- Data Processing Description
- Phenotype Type
- Phenotype Units

High-Dimensional Phenotypes: Usage Example




```
afp43@debian:~/projects/Brapi_R_nirs_test19$
```

High-Dimensional Phenotypes: Usage Example




```
R version 4.1.3 (2022-03-10) -- "One Push-Up"
Copyright (C) 2022 The R Foundation for Statistical Computing
Platform: x86_64-apple-darwin17.0 (64-bit)

R is free software and comes with ABSOLUTELY NO WARRANTY.
You are welcome to redistribute it under certain conditions.
Type 'license()' or 'licence()' for distribution details.

  Natural language support but running in an English locale

R is a collaborative project with many contributors.
Type 'contributors()' for more information and
'citation()' on how to cite R or R packages in publications.

Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

[Workspace loaded from ~/Documents/BTI/High Dimensional Nirs Brapi/Nirs_brapi/.RData]

> 
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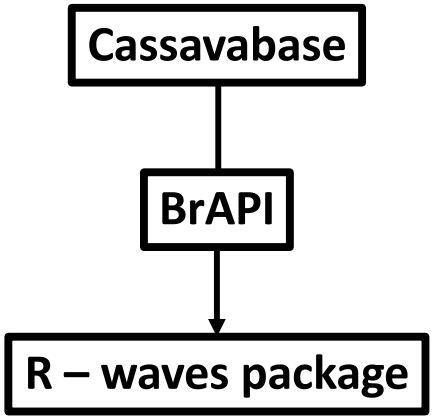
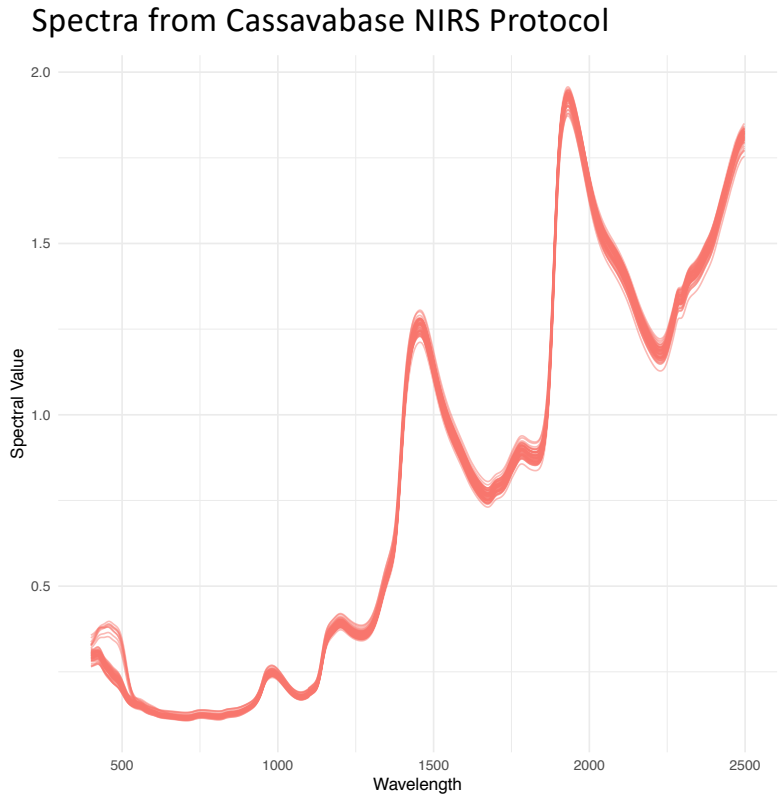
High-Dimensional Phenotypes: Usage Example



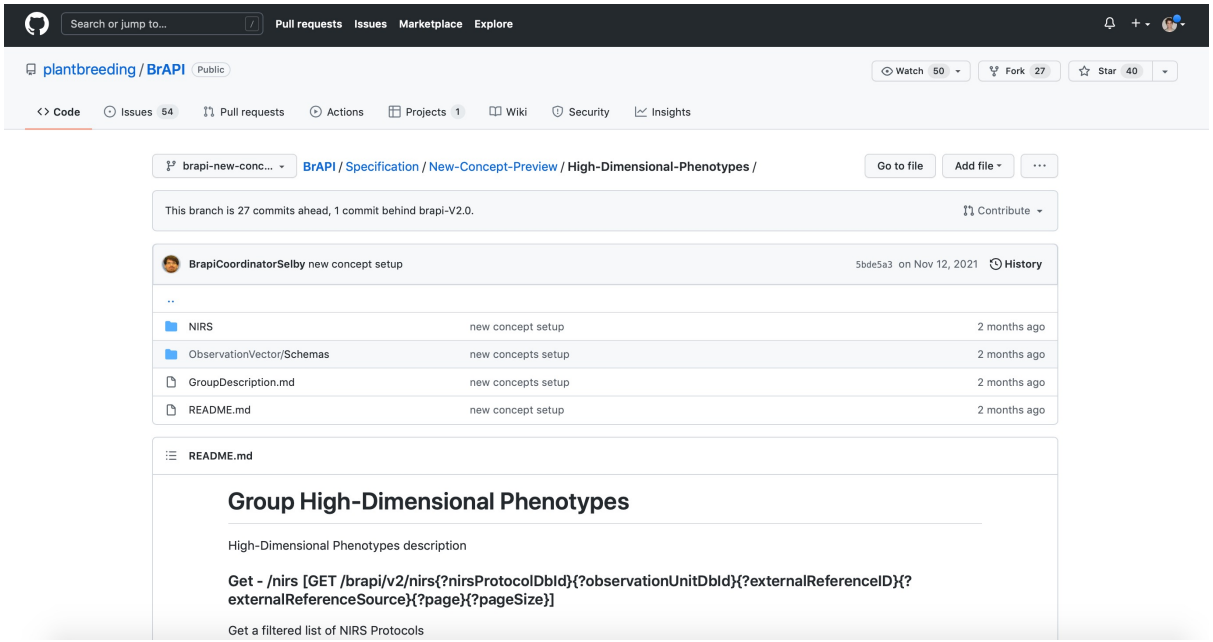


High-Dimensional Phenotypes: Ongoing Work

- Finalize and test transcriptomics calls
- Implement metabolomics calls
- Additional documentation and usage examples
- Other types of High-Dimensional Phenotypes?
    - Ground Penetrating Radar
    - Hue-Saturation-Value (HSV)
- Ensure compatibility with BrAPI-R package, etc.

High-Dimensional Phenotypes: New Concept Preview

https://brapinewconceptpreview.docs.apiary.io/

https://github.com/plantbreeding/BrAPI/tree/brapi-new-concept-preview/Specification/New-Concept-Preview/High-Dimensional-Phenotypes

https://app.swaggerhub.com/apis-docs/PlantBreedingAPI/BrAPI-New-Concept-Preview