Recognizing Mutants Among Us
Citizen Science Project
Jelena Brkljacic, Arabidopsis Biological Resource Center
Crowdsourcing to solve protein structures
ABRC Is Uniquely Positioned to Engage in Citizen Science

Large Collection: 930,000 accessions
- Seed stocks
- DNA Stocks
- Protein arrays
- Cell cultures
- Education Kits

Large Community: 27,000 researchers and educators in 73 countries

SALK homozygous mutant collection
50,000 confirmed SALK, SAIL, Wisc and GABI-Kat lines

Locus Coverage

No phenotype available
Genome-wide Functional Screens

SALK T-DNA mutant collection
- 2 independent mutants for each of ~25,000 Arabidopsis genes
- 50,000 homozygous mutants

The challenge: The number of lines is too large for a single lab to analyze

Alonso and Ecker, Nature Reviews 2006
Recognizing Mutants Among Us: Citizen Science Phenotyping Project

A solution: Using the citizen science model, engage high school students in the collection of basic phenotypic data on the SALK homozygous mutant collection.
Recognizing Mutants Among Us: Citizen Science Phenotyping Project

**Goals:**
- Help students make connections between genotype and phenotype
- Help researchers identify genes with new functions

- Mutant line info
- Mutant line seeds
- Lessons and protocols
- Data collection and validation
- Data analysis
- Identification of lines with phenotypes
- Data validation and display
Step 1: Providing The Tools

- Uniform seed quality
- Standardized growth conditions
- Reproducible phenotypes
Step 2: Data Collection and Validation

Data validation by teachers

Col-0
- Reference line

SALK_000003
- Late flowering
- Rosette leaf number increased

SALK_000004
- Glabrous

<table>
<thead>
<tr>
<th>Data</th>
<th>Number</th>
<th>Size</th>
<th>Shape</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Rosette Leaf:
- Number
- Size
- Shape
- Color

Number:
- ✔ Increased
- ❑ Decreased
## Step 3: Data Validation and Display

<table>
<thead>
<tr>
<th>Line ID</th>
<th>SALK_0000003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allele</td>
<td>SALK_0000003</td>
</tr>
<tr>
<td>Locus</td>
<td>AT1G13320</td>
</tr>
<tr>
<td></td>
<td>Protein Phosphatase 2A Subunit A3</td>
</tr>
<tr>
<td>Insertion position</td>
<td>Promoter</td>
</tr>
<tr>
<td>Phenotype</td>
<td>![Plant Image]</td>
</tr>
<tr>
<td>Standard conditions</td>
<td>16 h light/8 h dark</td>
</tr>
<tr>
<td>Rosette leaf number increased</td>
<td>(number of leaves at defined developmental stage)</td>
</tr>
<tr>
<td>Phenotype confirmed/Number of replications</td>
<td></td>
</tr>
<tr>
<td>Late flowering</td>
<td>(number of days required to begin flowering)</td>
</tr>
<tr>
<td>Phenotype confirmed/Number of replications</td>
<td></td>
</tr>
</tbody>
</table>
Step 4: Data Analysis: Linking Genotype to Phenotype

- Is the gene function known?
- What is the evidence?
- Are there other mutants available?
- Is there a phenotype detected for any of these?
- Is it similar to the phenotype identified by a student?
- Are there other gene family members?
- What is known about these?
- Are there known genetic pathways that this protein participate in?
- What is known about those pathways?

Leading students to understand the complexity of their genetic makeup and how it leads to their appearances, including those impacting their health
Connecting the Students and Researchers Through HUBzero

HUBzero® is a powerful, open source software platform for creating dynamic web sites that support scientific research and educational activities.

nees.org

Network for Earthquake Engineering Simulation (NEES)

NEES is a shared national network of 14 experimental facilities, collaborative tools, a centralized data repository, and earthquake simulation software.

see more hubs
The Impacts

**Researchers**
- Collaborate on standardizing phenotypes
- Search phenotypes
- Generate new hypotheses about gene functions

**Students**
- Improve scientific literacy
- Participate in real research
- Understand scientific process
- Communicate with researchers
Plant Academy

- New OSU/CAPS program to enhance K-12 education
- Expanding on the Greening the Classroom and ASPB-funded TRAINED program developed by ABRC
- Recognizing Mutants Among Us will be part of the Plant Academy program
- Distribution of mutant lines will be through ABRC (as an education kit)
**Objective:** Learn how plant genotype influence responses to environmental conditions and how this affects survival in a changing environment.
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