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A DBER Approach to Writing to Learn

Brian M. Waters
University of Nebraska-Lincoln, bwaters2@unl.edu

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A DBER Approach to Writing to Learn

Brian Waters
Associate Professor
Department of Agronomy and Horticulture
bwaters2@unl.edu
@WriteScientific
Outline:

Goals for today’s talk
My research shift into DBER
Pilot studies in Scientific Writing and Communication
Research interests
Scientific Writing Help Desk
My training:

**BS** in Agronomy
**MS** in Plant Physiology
**PhD** in Plant Physiology and Molecular Biology
Assistant Professor of Biology, McMurry University
**Postdoc** in Plant Molecular Biology
**Postdoc** in Plant Physiology and Genetics
Assistant, Associate Professor, UNL Department of Agronomy and Horticulture
National Science Foundation IOS: “Exploring iron and copper cross-talk in iron deficient *Arabidopsis thaliana*”

USDA-NIFA: Understanding Biological Mechanisms for Plant Production Program: “Discovering new aspects of iron uptake regulation controlled by the *fefe* gene”
University of Missouri, Columbia:
Plant Science Laboratory

McMurry University:
Principles of Biology
Botany
Cell Biology
Plant Physiology
Molecular Biology
Molecular Biology Techniques

University of Nebraska:
Genetics
Biofortification
Scientific Writing and Communication
University of Missouri, Columbia:
Plant Science Laboratory

McMurry University:
Principles of Biology
Botany
Cell Biology
Plant Physiology
Molecular Biology
Molecular Biology Techniques

University of Nebraska:
Genetics
Biofortification
Scientific Writing and Communication

ARISE program, Spring 2016
CIRTL steering committee, Fall 2016
Determining the most effective class activities for learning scientific writing
• Nearly all jobs in scientific fields require writing, usually technical or scientific writing

• Many undergraduate students are engaged in research, and are expected to write a senior or honors thesis or present a research poster

• However, most students have been given little training in writing, and few have training in scientific writing

• Many of these undergraduates will attend graduate school, where writing a thesis or dissertation and research articles are required
• Faculty usually expect graduate students (or even undergraduates) to be able to learn how to write a scientific manuscript simply by reading published papers.

• This method works well only for a few rare students, and some become “stuck” and do not finish their thesis.

• Most students will benefit from formal training in scientific writing. “Scientific Writing and Communication” was designed to fulfill this need.
Target audience for AGRO/HORT 403/803, Scientific Writing and Communication:

- Plant Biology and Horticulture (research option) senior undergraduates writing a senior/honors thesis (*Other science majors are welcome, too*)
- Graduate students writing a thesis/dissertation
Target audience for AGRO/HORT 403/803, Scientific Writing and Communication:

- Plant Biology and Horticulture (research option) senior undergraduates writing a senior/honors thesis (*Other science majors are welcome, too*)
- Graduate students writing a thesis/dissertation

<table>
<thead>
<tr>
<th>Student Demographics:</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>Sp2017</th>
<th>Total</th>
</tr>
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<tbody>
<tr>
<td>Undergraduate students</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>11</td>
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<tr>
<td>Graduate students</td>
<td>5</td>
<td>9</td>
<td>15</td>
<td>14</td>
<td>43</td>
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<table>
<thead>
<tr>
<th>Male</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>Sp2017</th>
<th>Total</th>
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<tr>
<td></td>
<td>4</td>
<td>7</td>
<td>11</td>
<td>11</td>
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<td>Female</td>
<td>6</td>
<td>5</td>
<td>6</td>
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<table>
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<th></th>
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<tr>
<td>Agronomy</td>
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<td>6</td>
<td>8</td>
<td>8</td>
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<tr>
<td>Horticulture</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Plant Biology</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Biological Systems Engineering</td>
<td>1</td>
<td>1</td>
<td></td>
<td>3</td>
<td></td>
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<tr>
<td>Agricultural and Biological Systems Engineering</td>
<td>2</td>
<td>2</td>
<td></td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Food Science</td>
<td>1</td>
<td>2</td>
<td></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Biology</td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Computer Science</td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Mechanical Engineering</td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Plant Pathology</td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Biomedical Engineering</td>
<td>1</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Natural Resources</td>
<td>1</td>
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<td>1</td>
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<tr>
<td>Nutrition</td>
<td>1</td>
<td></td>
<td></td>
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<table>
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<th></th>
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<td>English</td>
<td>7</td>
<td>8</td>
<td>8</td>
<td>4</td>
<td>27</td>
</tr>
<tr>
<td>English as second language</td>
<td>3</td>
<td>4</td>
<td>9</td>
<td>11</td>
<td>27</td>
</tr>
</tbody>
</table>
The course has three parts:

• Students learn to read and critically evaluate scientific literature in plant biology.
• Students write a research paper based on their own original research, and peer-review research papers of fellow students.
• Students prepare and present their research in a poster format.
As a scientific writing instructor, I need to know how to most efficiently and effectively use class time, and I need to know whether students are learning in my course.

Research Questions:

1. Did student knowledge of scientific writing and writing skill improve during the course?

2. What was the most effective activity for student learning in the course?

3. Did student confidence in scientific writing increase after taking the course?
Methods:

• First day knowledge quiz, which is repeated at the end of the course

• First day survey on initial experience, goals, and attitudes

• Final survey of attitudes about learning, confidence, and effectiveness of class activities

• Quantifying common writing errors in first drafts and final versions
### Results:


<table>
<thead>
<tr>
<th>Please indicate how strongly you agree with the following statements:</th>
<th>Strongly Agree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>The instructor reviews/edits of my drafts were helpful</td>
<td></td>
<td></td>
<td>8</td>
<td>92</td>
<td></td>
</tr>
<tr>
<td>After this course, my knowledge of scientific writing has improved</td>
<td></td>
<td></td>
<td></td>
<td>24</td>
<td>76</td>
</tr>
<tr>
<td>This course has been useful to my overall education</td>
<td></td>
<td></td>
<td>34</td>
<td>66</td>
<td></td>
</tr>
<tr>
<td>I would recommend this course to my peers</td>
<td></td>
<td></td>
<td>3</td>
<td>32</td>
<td>66</td>
</tr>
<tr>
<td>The peer reviews/edits of my drafts were helpful</td>
<td></td>
<td></td>
<td>13</td>
<td>26</td>
<td>61</td>
</tr>
<tr>
<td>Using the reader/writer form improved my ability to read and understand scientific papers</td>
<td>4</td>
<td>7</td>
<td>33</td>
<td>56</td>
<td></td>
</tr>
<tr>
<td>Discussing the four example papers was helpful</td>
<td></td>
<td></td>
<td>5</td>
<td>5</td>
<td>34</td>
</tr>
<tr>
<td>After this course, my skill in scientific writing has improved</td>
<td></td>
<td></td>
<td></td>
<td>47</td>
<td>53</td>
</tr>
<tr>
<td>The in-class writing time was useful</td>
<td>8</td>
<td>16</td>
<td>32</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>After this course my ability to read and evaluate scientific papers has improved</td>
<td></td>
<td></td>
<td>55</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>Editing my peers’ writing helped me learn about scientific writing</td>
<td></td>
<td>3</td>
<td>68</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>Reading the four example papers was helpful</td>
<td>3</td>
<td>5</td>
<td>50</td>
<td>42</td>
<td></td>
</tr>
<tr>
<td>Using the reader/writer form improved my ability to organize and write my scientific paper.</td>
<td>4</td>
<td>11</td>
<td>48</td>
<td>37</td>
<td></td>
</tr>
<tr>
<td>The order of the topics should not be changed</td>
<td>3</td>
<td>5</td>
<td>16</td>
<td>42</td>
<td>34</td>
</tr>
<tr>
<td>Reading about research of my peers helped me learn about plant science</td>
<td>5</td>
<td>5</td>
<td>26</td>
<td>34</td>
<td>29</td>
</tr>
<tr>
<td>The textbook for this class was useful</td>
<td>5</td>
<td>5</td>
<td>32</td>
<td>45</td>
<td>13</td>
</tr>
<tr>
<td>More time on example papers’ structure would have been helpful</td>
<td>29</td>
<td>34</td>
<td>32</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>The pace of the course was too fast</td>
<td>13</td>
<td>45</td>
<td>29</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td>The pace of the course was too slow</td>
<td>18</td>
<td>58</td>
<td>24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The in-class writing time encouraged me to wait until class time to begin writing</td>
<td>24</td>
<td>39</td>
<td>21</td>
<td>16</td>
<td></td>
</tr>
</tbody>
</table>
Research question 1: Did student knowledge of scientific writing and writing skill improve during the course?

Most students reported “Good” or “Great” improvement in areas of emphasis (2015+2016)

<table>
<thead>
<tr>
<th>After this class, please rate your improvement in:</th>
<th>None</th>
<th>Small</th>
<th>Moderate</th>
<th>Good</th>
<th>Great</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific writing ability</td>
<td>10.7</td>
<td>42.9</td>
<td>46.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Language/grammar/word use</td>
<td>28.6</td>
<td>42.9</td>
<td>28.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Writing an Introduction Section</td>
<td>7.1</td>
<td>57.1</td>
<td>35.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Searching for and citing sources</td>
<td>7.1</td>
<td>10.7</td>
<td>46.4</td>
<td>35.7</td>
<td></td>
</tr>
<tr>
<td>Making an effective scientific poster</td>
<td>3.6</td>
<td>7.1</td>
<td>57.1</td>
<td>32.1</td>
<td></td>
</tr>
<tr>
<td>Writing a Results Section</td>
<td>10.7</td>
<td>64.3</td>
<td>25.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Writing process/productivity</td>
<td>12.5</td>
<td>68.8</td>
<td>18.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Structuring a scientific paper to &quot;tell a true story&quot;</td>
<td>14.3</td>
<td>53.6</td>
<td>32.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learning from journal articles</td>
<td>6.3</td>
<td>18.8</td>
<td>56.3</td>
<td>18.8</td>
<td></td>
</tr>
<tr>
<td>Writing a Discussion Section</td>
<td>21.4</td>
<td>53.6</td>
<td>25.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clear and logical presentation</td>
<td>21.4</td>
<td>57.1</td>
<td>21.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Understanding the scientific writing and publishing process</td>
<td>3.6</td>
<td>17.9</td>
<td>57.1</td>
<td>21.4</td>
<td></td>
</tr>
</tbody>
</table>
Knowledge of scientific writing principles increased as indicated by quiz scores

<table>
<thead>
<tr>
<th>Year</th>
<th>Pre-course</th>
<th>Post-course</th>
<th>Change (%)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>11.3 ± 1.6</td>
<td>15.1 ± 2.1</td>
<td>33.6</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>2015</td>
<td>13.1 ± 2.9</td>
<td>17.5 ± 2.8</td>
<td>33.8</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>2016</td>
<td>11.8 ± 1.3</td>
<td>16.4 ± 2.7</td>
<td>39.0</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
Common error frequency decreased in final draft (2014)

**Introduction**
- Passive voice
- Missing results preview/significance
- Overview sentences
- Too wide background
- Too narrow background
- Obscured elements
- Missing Approach
- Missing Objectives
- Missing Research Question/ purpose
- Missing unknown/problem

**Discussion**
- Too narrow discussion
- Too wide discussion
- Passive voice
- Misuse of past/present tense
- Missing references to figures/tables
- Importance/significance not clear
- Missing conclusion
- Introduction in Discussion
- Results in Discussion
- Irrelevant or peripheral information
- Answer/Interpretation not in first paragraph

**Results**
- Irrelevant or peripheral information
- Missing emphasis or signaling
- Switching tense or wrong tense
- Discussion in results
- Methods in results
- Missing interpretation
- Missing results/stats as results
- Missing approach
- Missing Purpose

**Error frequency (%)**

- **First draft**
  - Error frequency (%): 0, 20, 40, 60, 80, 100, 120

- **Final version**
  - Error frequency (%): 0, 20, 40, 60, 80, 100, 120
Research question 2: What was the most effective activity for student learning in the course?

<table>
<thead>
<tr>
<th>Class Activity</th>
<th>2014 Overall Ranking</th>
<th>2015 Overall Ranking</th>
<th>2016 Overall Ranking</th>
<th>Combined Overall Ranking</th>
<th>UG Ranking</th>
<th>Grad Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revising my drafts using peer/instructor comments</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Writing my drafts</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
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<tr>
<td>Class lectures and powerpoints</td>
<td>9</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>3</td>
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<tr>
<td>Discussing the four example papers</td>
<td>3</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Searching for and reading papers to cite</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Reading the four example papers</td>
<td>7</td>
<td>6</td>
<td>9</td>
<td>6</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>Reviewing/editing my peers' work</td>
<td>4</td>
<td>7</td>
<td>8</td>
<td>7</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>Using the reader/writer form</td>
<td>(NA)</td>
<td>10</td>
<td>6</td>
<td>8</td>
<td>9</td>
<td>7</td>
</tr>
<tr>
<td>Reading my peers' work</td>
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<td>9</td>
<td>7</td>
<td>9</td>
<td>8</td>
<td>8</td>
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<td>Textbook reading</td>
<td>10</td>
<td>8</td>
<td>12</td>
<td>10</td>
<td>11</td>
<td>11</td>
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<tr>
<td>Reverse outlining</td>
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<td>12</td>
<td>11</td>
<td>11</td>
<td>10</td>
<td>12</td>
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<tr>
<td>Links and extra articles on Blackboard</td>
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<td>11</td>
<td>10</td>
<td>12</td>
<td>12</td>
<td>10</td>
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</tbody>
</table>
Research question 3: Did student confidence in scientific writing increase after taking the course?

<table>
<thead>
<tr>
<th></th>
<th>Not at all</th>
<th>Somewhat</th>
<th>Moderately</th>
<th>Quite</th>
<th>Very</th>
</tr>
</thead>
<tbody>
<tr>
<td>How confident are you in your ability to read and analyze a scientific paper right now?</td>
<td>-3</td>
<td>-23</td>
<td>-32</td>
<td>34</td>
<td>25</td>
</tr>
<tr>
<td>How confident are you in your ability to find and cite appropriate literature related to your manuscript right now?</td>
<td>0</td>
<td>-20</td>
<td>-30</td>
<td>16</td>
<td>33</td>
</tr>
<tr>
<td>How confident are you in your ability to write a scientific paper right now?</td>
<td>-20</td>
<td>-36</td>
<td>-8</td>
<td>36</td>
<td>29</td>
</tr>
</tbody>
</table>

(% change in frequency between first day and last day surveys, 2015+2016)
Conclusions:

- Student *knowledge* and *skill* in scientific writing improved after taking “Scientific Writing and Communication”

- “Writing my drafts” and “Revising my drafts...” were ranked as the most effective activities. This feedback suggests that a full-semester course with multiple drafts, peer review, and revisions is more effective than a workshop or short course without writing practice.

- Student confidence in the ability to write scientific manuscripts increased after taking this course. This improvement could lead to increased success for undergraduates, and increased graduate student retention and graduation rates.
Outline:

Goals for today’s talk
My research shift into DBER
Pilot studies in Scientific Writing and Communication
Research interests

  Effectiveness of writing to learn activities
  Student peer reviewing
  Trends in scientific publishing

Scientific Writing Help Desk
Annotations

Students actively engage the material

- Students note the purpose and scope of a reading in context of the course
- They identify key ideas or themes
- They evaluate strengths and weaknesses
Natural Variants of AtHKT1 Enhance Na\textsuperscript{+} Accumulation in Two Wild Populations of Arabidopsis

Ana Russo, Ivan Baxter, Balababramaniam Muthukumar, Jeff Gustin, Brett Lahner, Elena Yakubova, David E. Salt

Center for Plant Environmental Stress Physiology, Purdue University, West Lafayette, Indiana, United States of America

Plants are sessile and therefore have developed mechanisms to adapt to their environment, including the soil mineral nutrient composition. Ionomics is a developing functional genomic strategy designed to rapidly identify the genes and gene networks involved in regulating how plants acquire and accumulate these mineral nutrients from the soil. Here, we report on the coupling of high-throughput elemental profiling of shoot tissue from various Arabidopsis accessions with DNA microarray-based bulk segregant analysis and reverse genetics. For the rapid identification of genes from wild populations of Arabidopsis thaliana that are involved in regulating how plants acquire and accumulate Na\textsuperscript{+} from the soil, elemental profiling of shoot tissue from 12 different Arabidopsis accessions revealed that two coastal populations of Arabidopsis collected from Tossa del Mar, Spain, and Tsu, Japan (Ts-1 and Tsu-1, respectively), accumulate higher shoot levels of Na\textsuperscript{+} than do Col-0 and other accessions. We identify AtHKT1, known to encode a Na\textsuperscript{+} transporter, as being the causal locus driving elevated shoot Na\textsuperscript{+} in both Ts-1 and Tsu-1. Furthermore, we establish that a deletion in a tandem repeat sequence approximately 5.5 kb upstream of AtHKT1 is responsible for the reduced root expression of AHKT1 observed in these accessions. Reciprocal grafting experiments establish that this loss of AtHKT1 expression in roots is responsible for elevated shoot Na\textsuperscript{+}. Interestingly, and in contrast to the Hkt1-- null mutant, under Na\textsuperscript{+} stress conditions, this novel AtHKT1 allele not only does not confer Na\textsuperscript{+} sensitivity but also cosegregates with elevated Na\textsuperscript{+} tolerance. We also present all our elemental profiling data in a new open access ionomics database, the Purdue Ionomics Information Management System (PIIMS, http://www.purdue.edu/dip/ionomics). Using DNA microarray-based genotyping has allowed us to rapidly identify AtHKT1 as the causal locus driving the natural variation in shoot Na\textsuperscript{+} accumulation we observed in Ts-1 and Tsu-1. Such an approach overcomes the limitations imposed by a lack of established genetic markers in most Arabidopsis accessions and opens up a vast and tractable source of natural variation for the identification of gene function not only in ionomics but also in many other biological processes.


Introduction

Plants are sessile and therefore have developed mechanisms to adapt to their environment, including the soil mineral nutrient composition. High-throughput elemental profiling of Arabidopsis thaliana (Arabidopsis) has been used in an effort to identify the genes and gene networks involved in regulating how plants acquire and accumulate mineral nutrients and trace elements from the soil [1]. In 2003, Lahner et al. [1], in a screening of 6,000 fast-neutron-mutagenized Arabidopsis plants grown under unstressed conditions, identified 51 mutants with altered shoot elemental profiles, and they estimated that about 2% to 4% of the Arabidopsis genome is involved in regulating the elemental composition or "ionome" of Arabidopsis (for review, see [2]), including accumulation of macronutrients, micronutrients, and nonessential elements such as Na\textsuperscript{+}. Recently, one of these ionomic mutants was shown to harbor a deletion in AtHKT1 that is responsible for the elevated shoot Na\textsuperscript{+} phenotype of this mutant [3]. As an alternative to induced mutations (fast-neutron, ethyleneimine sulfonate, etc.), the large reservoir of natural variation that exists in Arabidopsis is also a potentially powerful resource for the investigation of the biological functions of HKT1. Such natural variation has the advantage over induced mutations in that uncovering the adaptive significance of such variation provides tools for the integration of gene function in the context of whole plant physiology. However, this genetic resource is still underexploited, mainly because natural phenotypic variation is usually the result of genotypic variation at multiple loci. Even when dealing with monogenic traits, it is a major challenge to identify a particular gene controlling a phenotype of interest. Currently, fewer than ten genes have been identified in Arabidopsis that modify the natural variation approach [7,8], whereas variation in multiple traits such as flood and nutrient...
Natural Variants of AtHKT1 Enhance Na⁺ Accumulation in Two Wild Populations of Arabidopsis

Ana Ruo, Ivan Baster, Balasubramaniam Mathukumal, Jeff Gustin, Brett Lahner, Elena Yakubova, David E. Salt
Center for Plant Environmental Stress Physiology, Purdue University, West Lafayette, Indiana, United States of America

Plants are sessile and therefore have developed mechanisms to adapt to their environment, including the soil mineral nutrient composition. Ionomics is a developing functional genomic strategy designed to rapidly identify the genes and gene networks involved in regulating how plants acquire and accumulate these mineral nutrients from the soil. Here, we report on the coupling of high-throughput elemental profiling of shoot tissue from various Arabidopsis accessions with DNA microarray-based bulk segregant analysis and reverse genetics, for the rapid identification of genes from wild populations of Arabidopsis that are involved in regulating how plants acquire and accumulate Na⁺ from the soil. Elemental profiling of shoot tissue from 12 different Arabidopsis accessions revealed that two coastal populations of Arabidopsis collected from Tossa del Mar, Spain, and Tsu, Japan (Ts-1 and Tsu-1, respectively), accumulate higher shoot levels of Na⁺ than do Col-0 and other accessions. We identify At HKT1, known to encode a Na⁺ transporter, as being the causal locus driving elevated shoot Na⁺ in both Ts-1 and Tsu-1. Furthermore, we establish that a deletion in a tandem repeat sequence approximately 5 kb upstream of At HKT1 is responsible for the reduced root expression of At HKT1 observed in these accessions. Reciprocal grafting experiments establish that this loss of At HKT1 expression in roots is responsible for elevated shoot Na⁺. Interestingly, and in contrast to the Hkt1-1 null mutant, under NaCl stress conditions, this novel At HKT1 allele not only does not confer NaCl sensitivity but also cosegregates with elevated NaCl tolerance. We also present all our elemental profiling data in a new open access ionomics database, the Purdue Ionomics Information Management System (PIIMS, http://www.purdue.edu/dip/ionomics). Using DNA microarray-based genotyping has allowed us to rapidly identify At HKT1 as the causal locus driving the natural variation in shoot Na⁺ accumulation we observed in Ts-1 and Tsu-1. Such an approach overcomes the limitations imposed by a lack of established genetic markers in most Arabidopsis accessions and opens up a vast and tractable source of natural variation for the identification of gene function not only in ionomics but also in many other biological processes.

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As an alternative to induced mutations (fast-neutron, ethylmethylsulfonate, etc.), the large reservoir of natural variation that exists in Arabidopsis is also a potentially powerful resource for the investigation of functional gene function [4-6]. Such natural variation has the advantage over induced mutations in that uncovering the adaptive significance of such variation provides tools for the integration of gene function in the context of whole plant physiology. However, this genetic resource is still underexploited, mainly because natural phenotypic variation is usually the result of genotypic variation at multiple loci. Even when dealing with monogenic traits, it is a major challenge to identify a particular gene controlling a phenotype of interest. Currently, fewer than ten genes have been identified in Arabidopsis passing the natural variation approach [7], whereas variation in multiple traits such as yield and resistance.
Scientific Paper Reader/Writer Outline Form

Background
- As we understand, Arabidopsis may help us understand how plants adapt to environments.
- May be able to use natural variation rather than induced mutations.
- Basic segregant analysis + element profiling
- ATHK1 novel allele found from Spanish & Japanese accessions - ATHK1 regulates Na+ concentration/movement in tissues.

Research Question/Purpose
- "Can we find cool mutants that have arisen "naturally" for an important ion movement gene?"

Objectives
- Evaluate natural variation for traits related to ionome of a plant.
- Characterize genetic differences using 78K element profiling.
- Compare old genes to literature.

Approaches
- 12 accessions - shoot tissue, genotype examined, under salinity stress, evaluate phenotype differences.
- Cross accessions of interest to Col-0 (" smear") & evaluate F1, F2.
- Microarray BSA 10 F2s.
- Trait mapped to chromosome 4, compare to ref. sequence genes in that region.
- ATHK1 of interest.
- Compare alleles of ATHK1
- RT-PCR to look at expression profile.
- Grafting to see responses to ATHK1 & movement of Na.

Knowledge Gap
- "not well specified by writers"
- more of a "let's see what we find" approach.

Answer to RQ/KG
- ATHK1 is important.
- Natural variation exists for Na+ related traits.
- Provide conclusion/ending to this paper.

Conclusions
- ATHK1 is known to have an effect on Na+ movement.
- Novel alleles may help explain plant response/paths.
- Other genes may be important & regulate ATHK1

Unanswered Questions
- "What next?"
Outline:

Goals for today’s talk
My research shift into DBER
Pilot studies in Scientific Writing and Communication
Research interests
  Effectiveness of writing to learn activities
  **Student peer reviewing**
  Trends in scientific publishing
Scientific Writing Help Desk
Peer Review

- Student authors learn from feedback
- Student reviewers learn by increased awareness of common mistakes or successful writing
- Student authors learn by reflecting on feedback during the revision process
Class 1: Discuss how to write section

Between classes: Write new section, adding to previous section(s).

Class 2: Work on section and ask questions in class. Turn in section to reviewers as Word file by uploading to Canvas folder (by midnight).

Between classes: Download and print peer review forms and manuscripts. Edit and comment on manuscript; fill out peer review form.

Class 3: Go over peer reviews with authors.

Between classes: Revise manuscript and write response to reviewers.
Introduction Peer Review form

Author:
Peer Reviewer:

Identify elements by line no.:

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<thead>
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<th>Line number(s)</th>
<th>Missing</th>
<th>Unclear</th>
<th>Somewhat clear</th>
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Give line numbers with comments as appropriate.

Explain how any of the elements above were obscured.

Were any tenses used incorrectly? If so, list line numbers.

Comment on the background information relevance to the research question. Is it too wide or too narrow?

Comment on the number of references (e.g. too few/many), their placement, and their format.

What do you expect the rest of this paper to be about?

Comment on the length of the Introduction.

Comment on organization of the section and/or paragraphs.

Give two (or more) suggestions for how to improve the section.
Goals for today’s talk
My research shift into DBER
Pilot studies in Scientific Writing and Communication
Research interests
  Effectiveness of writing to learn activities
  Student peer reviewing
  Trends in scientific publishing
Scientific Writing Help Desk
The Waters DBER program is focused on identifying and overcoming barriers to learning in the plant sciences and agriculture.

The main focus of the Waters DBER program is to understand how students learn *by reading* about scientific research, and how students learn *by writing* about scientific concepts and practice.

The goal of the Waters DBER program is to develop and study practices for faculty to incorporate writing with feedback and revisions into their classes.
Survey: Investigating the use of writing assignments to improve student writing skills in the College of Agriculture and Natural Sciences (CASNR)

In collaboration with Sydney Brown, Innovative Instructional Design

Purpose:
• Understand how instructors use writing assignments in CASNR courses at UNL
• Better understand student weaknesses in writing

Application:
• Improve support for students' science and scientific writing
• Support instructors in their development and use of writing assignments
Survey: Investigating the use of writing assignments to improve student writing skills in the College of Agriculture and Natural Sciences (CASNR)

1. What is your position? (Prof. of Practice, Asst. Prof., Adjunct, etc.)

2. If any of your classes use writing assignments or activities, or writing as part of assignments, please briefly describe the assignment/activity.

3. How do you envision the ways students currently use writing (of any kind) in their academic program and daily lives? Please list as many as you can.

4. How do you envision your students will use writing in their future careers? Please list as many as you can.

5. What are the barriers or limitations you face in designing, assigning, assessing, or grading writing assignments in your classes?

6. What are the key problems or weaknesses of your students in completing their assignments (at any stage of the process, including literature or other research before beginning to write)?

7. Is there anything else you would like to share about writing assignment practices and/or students’ writing or writing-related skills in CASNR?
How could the Scientific Writing Help Desk be useful to you or your students?

Your feedback and ideas are requested!

Collaborations ideas are also welcome.