ENTERPRISE INSTITUTE

SCIENTISTS MADE

36

PRESENTATIONS
TO UNIVERSITIES,
SYMPOSIA AND
CORPORATE
AUDIENCES ACROSS
THE U.S., CANADA,
SOUTH AMERICA,
EUROPE AND ASIA.
DISCOVERY AND TRANSLATION - exploring fundamental science about genes and systems that underlie solar energy capture and conversion into oils, sugars and biomass and translating Enterprise Institute discoveries into marketable technologies.

- Developed a technology to produce high-energy cyclic hydrocarbons, a component of jet fuel, in Camelina sativa seeds.
- Sequenced the genes of Dicanthelium oligosanthes (rosette grass), a model system for comparative genomic studies of bioenergy grasses.
- Sequenced the genome of Spirodela polyrhiza (duckweed), a potential bioenergy crop.
- Identified new metabolic and regulatory processes that improve seed oil production.
- Identified a regulatory gene that enhances seed size and yield in the biodiesel crop, Camelina sativa.
- Discovered a G protein that facilitates nitrogen uptake in roots, suggesting a route to using less fertilizer in bioenergy crops.

The Institute does high-risk research with the potential to alter current paradigms for bioenergy crops. Technologies are developed to improve bioenergy grasses and the production of plant and algal-based oils with the ultimate goal of production at commercial scale.

SCIENTIFIC HIGHLIGHTS

SUBMITTED
7
INVENTION DISCLOSURES OF BIOENERGY TECHNOLOGIES

FILED
8
BIOENERGY PATENT APPLICATIONS

LICENSED
6
TECHNOLOGIES TO FOR-PROFIT COMPANIES
INNOVATION - incorporating cutting-edge technologies to accelerate discovery.

- Conducted the first large-scale field trial in collaboration with the University of Illinois to identify genes that contribute to drought tolerance in Setaria, a model plant for bioenergy feedstocks.
- Developed and launched a high throughput phenotyping system, which automates measurements of biomass, light energy capture, and water use to more quickly and accurately identify important traits.
- Implemented a new state-of-the-art confocal microscope in the Danforth Center’s Integrated Microscopy Facility.
- Developed advanced photobioreactors for experimentation with algae.
- Combined newly developed computational approaches with high-resolution mass spectrometry and isotopic labeling to better understand plant metabolism.

NEXT GENERATION SCIENTISTS - the Enterprise Institute is committed to training collaborative disciplinary teams focused on bioenergy research.

- Twenty-three postdoctoral trainees and 19 graduate students are an integral part of the Institute’s research team.
- Five prestigious fellowships were awarded to postdoctoral trainees working in the Enterprise Institute:
  - USDA National Institute for Food and Agriculture Fellowship to identify factors that regulate gene expression in Camelina sativa.
  - Japan Society for the Promotion of Science to investigate the evolution of reproductive cycles in green algae.
  - Life Science Research Fund Fellowship to examine C4 photosynthesis using Setaria, corn and rice.
  - National Science Foundation (NSF) to study parallel evolution and gene regulatory changes between C3 and C4 grass species.
  - NSF Fellowship to study cold, heat and drought stress tolerance of Brachypodium distachyon, a model plant for bioenergy grasses.

- Nine undergraduate students were trained in Enterprise Institute labs as part of the Center’s NSF funded Research Experiences for Undergraduates summer internship program.
- More than 400 students from area high schools participated in the Mutant Millets program, a partnership between students, teachers and plant scientists to discover new plant traits.


**2013 ACTIVE GRANTS AND CONTRACTS**

<table>
<thead>
<tr>
<th>TITLE</th>
<th>AGENCY</th>
<th>START/END</th>
<th>TOTAL GRANT</th>
</tr>
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<tbody>
<tr>
<td>National Alliance for Advanced Biofuels and Bioproducts</td>
<td>DOE</td>
<td>April 2010 - April 2014</td>
<td>$31,069,307</td>
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<tr>
<td>Engineering C3 plants with carbon concentrating mechanisms for enhanced photosynthesis</td>
<td>National Science Foundation (NSF)</td>
<td>Aug. 2011 - Feb. 2014</td>
<td>$218,117</td>
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<td>Defining determinants and dynamics of cellulose microfibril biosynthesis, assembly and degradation</td>
<td>Cornell University (DOE)</td>
<td>Jan. 2012 - Aug. 2014</td>
<td>$400,539</td>
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<td>Center for Enhanced Camelina Oils</td>
<td>DOE-ARPA</td>
<td>Jan. 2012 - Jan. 2015</td>
<td>$7,078,897</td>
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<td>Commercial contract</td>
<td>NewLeaf Symbiotics</td>
<td>May 2012 - April 2015</td>
<td>$12,076</td>
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<tr>
<td>National Plant Genome Initiative Postdoctoral Fellowship</td>
<td>NSF</td>
<td>July 2012 - July 2015</td>
<td>$197,000</td>
</tr>
<tr>
<td>The structure function of the novel protein LC1B and related proteins with the CO₂ concentrating mechanisms of <em>Chlamydomonas reinhardtii</em></td>
<td>Iowa State University (DOE)</td>
<td>Aug. 2012 - Aug. 2015</td>
<td>$64,708</td>
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<tr>
<td>Biosciences Fellowship</td>
<td>Life Sciences Research Foundation</td>
<td>Aug. 2012 - July 2015</td>
<td>$168,000</td>
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<tr>
<td>National Institute for Food and Agriculture Fellowship</td>
<td>US Dept. of Agriculture</td>
<td>Aug. 2012 - Aug. 2014</td>
<td>$130,000</td>
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<td>Major Research Instrumentation: Acquisition of a Confocal Microscopy System</td>
<td>NSF</td>
<td>2013</td>
<td>$476,000</td>
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<td>Postdoctoral Fellowship for Young Scientists</td>
<td>Japan Society for the Promotion of Science</td>
<td>Oct. 2012 - March 2014</td>
<td>$64,000</td>
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<td>A systems-level analysis of drought and density response in the model C4 grass <em>Setaria viridis</em></td>
<td>DOE</td>
<td>Sept. 2012 - Aug. 2017</td>
<td>$12,140,437</td>
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<tr>
<td>National Plant Genome Initiative Postdoctoral Fellowship</td>
<td>NSF</td>
<td>July 2013 - May 2016</td>
<td>$216,000</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td><strong>$67,609,801</strong></td>
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Danforth Center scientists published their bioenergy discoveries in 26 peer-reviewed articles, (11 representative articles shown).
ENTERPRISE RENT-A-CAR INSTITUTE FOR RENEWABLE FUELS

The Enterprise Rent-A-Car Institute for Renewable Fuels is a research unit within the Donald Danforth Plant Science Center, and was established in 2007 with a generous gift from the Taylor family. The mission of the Enterprise Institute is to develop and apply technologies to enhance the potential of oilseed crops, algae and bioenergy grasses as sources of sustainable bioenergy.

www.danforthcenter.org