National Alliance For Advanced Biofuels and Bio-products

An Algal Biofuels Consortium

Algae R&D Activities Peer Review

Alexandria, Virginia

May 22, 2013

Presented by the NAABB Executive Team

This presentation does not contain any proprietary, confidential, or otherwise restricted information

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NAABB Executive Team

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New Mexico State University

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NAABB Sustainability Team Leader
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NAABB Agenda For Peer Review Meeting

Introduction to the NAABB Program and Team – *José A. Olivares*

1. **Approach: The NAABB Framework** – *Dan Anderson*
2. **Technical Accomplishments/Progress/Results from NAABB**
   - UPSTREAM Technologies – *Dick Sayre*
     - Algal Biology and Cultivation
   - DOWNSTREAM Technologies – *Kim Ogden*
     - Harvesting and Extraction; Conversion; Coproducts
   - SUSTAINABILITY Efforts (TEA/LCA) – *James Richardson*
     - Algal Integrated Simulation Modeling System
     - Sustainability Scenarios

Summary – *John Holladay*

3. **Relevance**
4. **Critical Success Factors**
5. **Future Work and Summary**

Purpose of NAABB

NAABB is developing and demonstrating the science and technology that will significantly increase production of algal biomass and lipids, efficiently harvest and extract algae and algal products, and establish valuable conversion routes to fuels and co-products.

NAABB Projected Objectives Outcomes

Objectives	Outcomes
Developing technologies for cost-effective production of algal biomass and lipids	
1.0: Algal Biology - Increase overall productivity of algal biomass accumulation and lipid/hydrocarbon content	Super-performing, safely-deployable, algal biofuel production strains with greater overall productivity and enhanced lipid production
2.0: Cultivation - Increase overall productivity by optimizing sustainable cultivation and production systems	Scalable cultivation practices for various environments. Optimized growth rates and lipid/hydrocarbon concentrations
3.0: Harvesting/Extraction - Develop cost-effective and energy efficient harvesting and lipid extraction technologies	Innovative, low-energy, algal harvesting and lipid/hydrocarbon extraction technologies integrated with cultivation and conversion processes
Developing economically viable fuels and co-products	
4.0: Fuel Conversion - Develop technologies to convert lipids/hydrocarbons and biomass residues into useful fuels	Optimized conversion technologies for algal extracts and whole algae into drop-in transportation fuels
5.0: Valuable Coproducts – Develop a set of valuable coproducts to add profitability and provide flexibility to allow responsiveness to changing demands/opportunities in the market.	New certified animal and mariculture feed products from algae biomass validated by FDA and cost-effective technologies for the production of large-scale, marketable co-products
Providing a framework for a sustainable algal biofuels industry	
6.0: Sustainability Analysis – Quantitatively assess the energy, environment, economic viability and sustainability of the NAABB approaches to guide our strategy	Sustainable processes and resource management. Life-cycle and economic analyses embedded in advanced system-level models.

NAABB Vision and Targets

The NAABB will develop technologies for cost-effective production of algal biomass and lipids, economically viable fuels and co-products, and provide a framework for a sustainable biofuels industry.

Process Economics Drivers

- < $2.10 /gal of lipid
- Operating cost
  $0.40/gal processing cost (oil)
- Capital Cost (Industry benchmarks for oil)
  $1/annual gallon installed capacity (biodiesel)
  $2/annual gallon installed capacity (green diesel)

Productivity Targets

- >50% lipid content at harvest
- >20 g/m^2/day productivity (open system)
- 5g dw/l yield (closed system)

Harvesting and Extraction Targets

- 5,000 gal/day processing for harvesting unit
- 15 gal/day lipid extraction capacity per unit

Co-product Targets

- LEA feed value $250-1000 /ton

Sustainability

- Reduced CO_2 Emissions
- Water usage: less than 0.75 gal H_2O / gal fuel
- Nutrient recycle
- LEA: 90% recycle nutrients
- Energy required for conversion is 10% or less of energy in fuel
- Energy Return on Investment (>> 1)

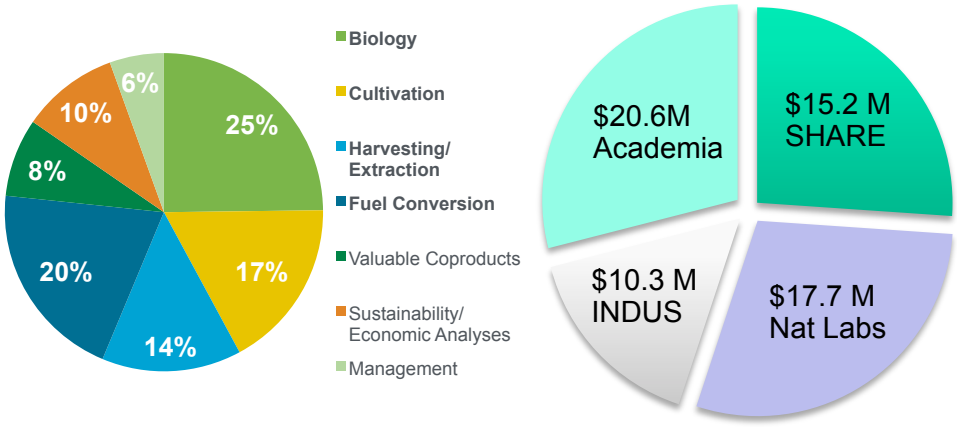
Quad Chart Overview

Timeline

- Project start date: April 5, 2010
- Project end date: September 30, 2013
  - R&D Ended April 4, 2013
- Percent complete: 99%

Budget

- Total project funding
  - DOE share: $48.6 M
  - Contractor share: $15.2 M
- Funding for FY13: $14.8 M
- ARRA Funding



Barriers Addressed

- Ft-A. Feedstock Availability and Cost
- Ft-B. Sustainable Production
- Ft-C. Feedstock Genetics and Development
- Ft-D. Sustainable Harvesting
- Ft-G. Feedstock Quality and Monitoring
- Ft-N. Algal Feedstock Processing
- Bt-A. Biomass Fractionation
- Bt-B. Biomass Variability
- Bt-K. Biological Process Integration
- Tt-A. Feeding Dry Biomass
- Tt-B. Feeding or Drying Wet Biomass
- Gt-C. Gasification of Biomass
- Tt-E. Pyrolysis of Biomass and Bio-Oil Stabilization
- Tt-G. Fuel Synthesis and Upgrading
- St-A. Scientific Consensus on Bioenergy Sustainability
- St-C. Sustainability Data across the Supply Chain
- St-D. Indicators and Methodology for Evaluating Sustainability
- St-F. Systems Approach to Bioenergy Sustainability

Partners (Next Slide): 39 member institutions, Integrated PM team

NAABB Algal Biofuels Consortium Partners

Lead Institution: The Donald Danforth Plant Center*†

* NAABB Team Management
† NAABB Board of Directors

National Laboratories

- Los Alamos National Laboratory / New Mexico Consotrtium*†
- Pacific Northwest National Laboratory*†
- Idaho National Laboratory
- National Renewable Energy Laboratory
- USDA - ARS

Universities

- Brooklyn College
- Clarkson University
- Colorado State University*†
- Iowa State University
- Michigan State University†
- New Mexico State University*†
- North Carolina State University
- Texas AgriLife Research / Texas A&M University System*†
- University of Arizona*†
- University of California Los Angeles
- University of California Riverside
- University of California San Diego
- University of Pennsylvania
- University of Texas (sub)
- University of Washington
- Washington State University
- Washington University St. Louis

Industry

- Albermarle Catilin†
- Diversified Energy
- Eldorado Biofuels
- Genifuel
- Cellana†
- Inventure
- Kai BioEnergy
- Palmer Labs
- Phycal
- Reliance Industries Limited
- Pan Pacific, Ltd.
- Solix Biofuels*†
- Targeted Growth†
- Terrabon
- UOP a Honeywell Company†
- Valicor

NAABB Members

Project Overview: Management/Integration

NAABB
National Alliance For Advanced Biofuels and Bio-products

NAABB Executive Team

José Olivares (LANL/Danforth)
Executive Director

Richard Sayre (LANL)
Scientific Director

John Holladay (PNNL)
Operations

John Mott (LANL)
Industry Relations

Kimberly Ogden (UA)
Engineering

Meghan Downes (NMSU)
Economics

Dan Anderson (PNNL)
Operations

Hal Davies (Danforth)
Finances

Algal Biology

Jon Magnuson (PNNL)

Cliff Unkefer (LANL)

Algal Cultivation

Pete Lammers (Solix)

Mike Huesemann (PNNL)

Wiebke Boeing (NMSU)

Harvesting and Extraction

Ron Lacey (TAMU)

Babetta Marrone (LANL)

Fuel Conversion and Coproducts

Richard Hallen (PNNL)

Anthony Marchese (CSU)

Sustainable Practices

Jim Richardson (TAMU)

Meghan Downes (NMSU)

Animal Feed

Tryon Wickersham (TAMU)

Shanna Ivey (NMSU)

Project Overview: Management/Integration

Project Management

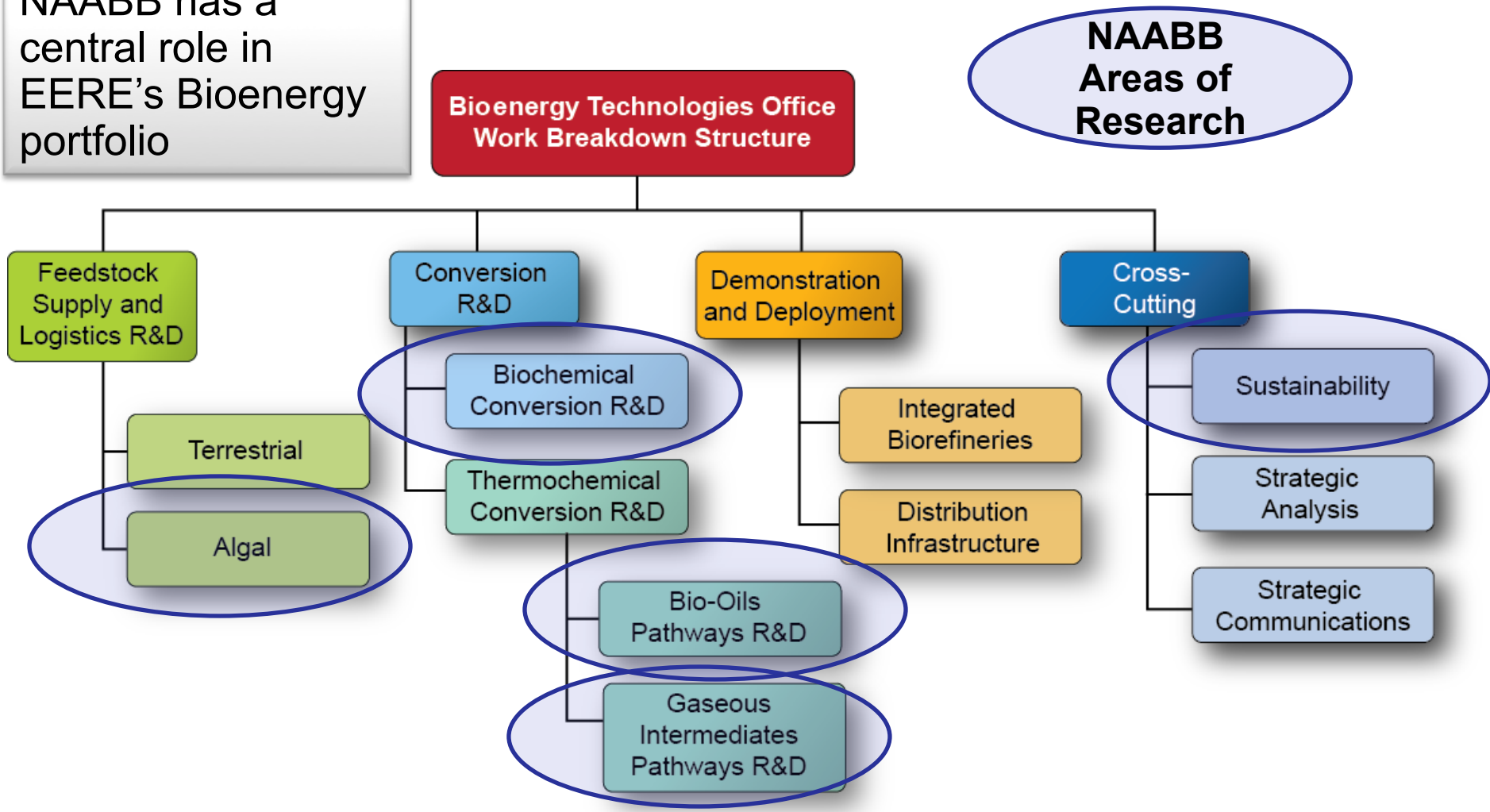
- Execution & Oversight
- Budget/Contract management
- Coordination & data sharing
- Technology transfer & intellectual property management

Communication

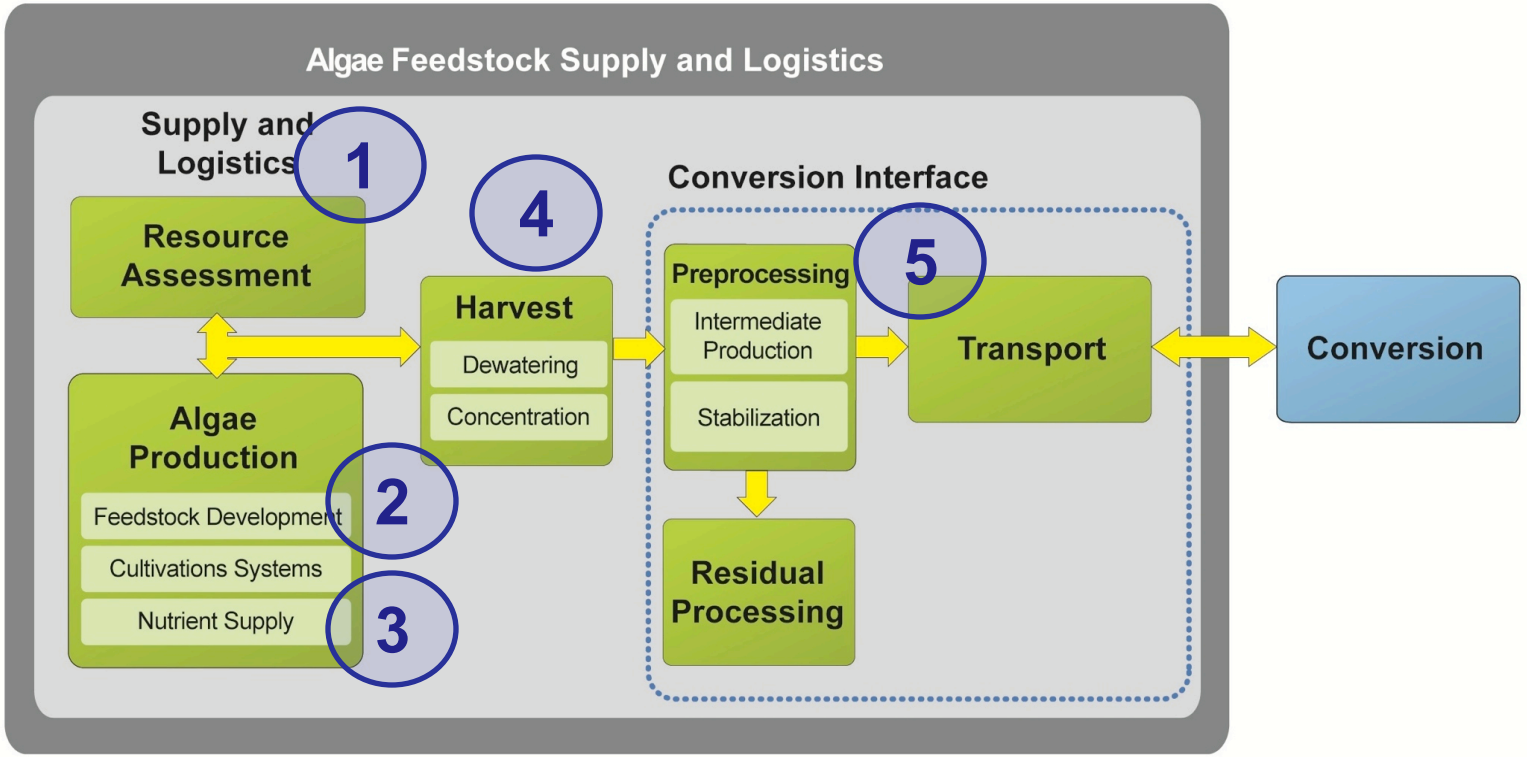
- Weekly meetings
  - Operations team and DOE Program team
- Biweekly meetings
  - Executive team
  - Team leads
- Monthly meetings
  - Teams and sub-teams
- NAABB PIs Collective meetings
  - Held 2x yearly
  - Regular colloquia
  - National/international Conference

Relevance

NAABB has a central role in EERE's Bioenergy portfolio



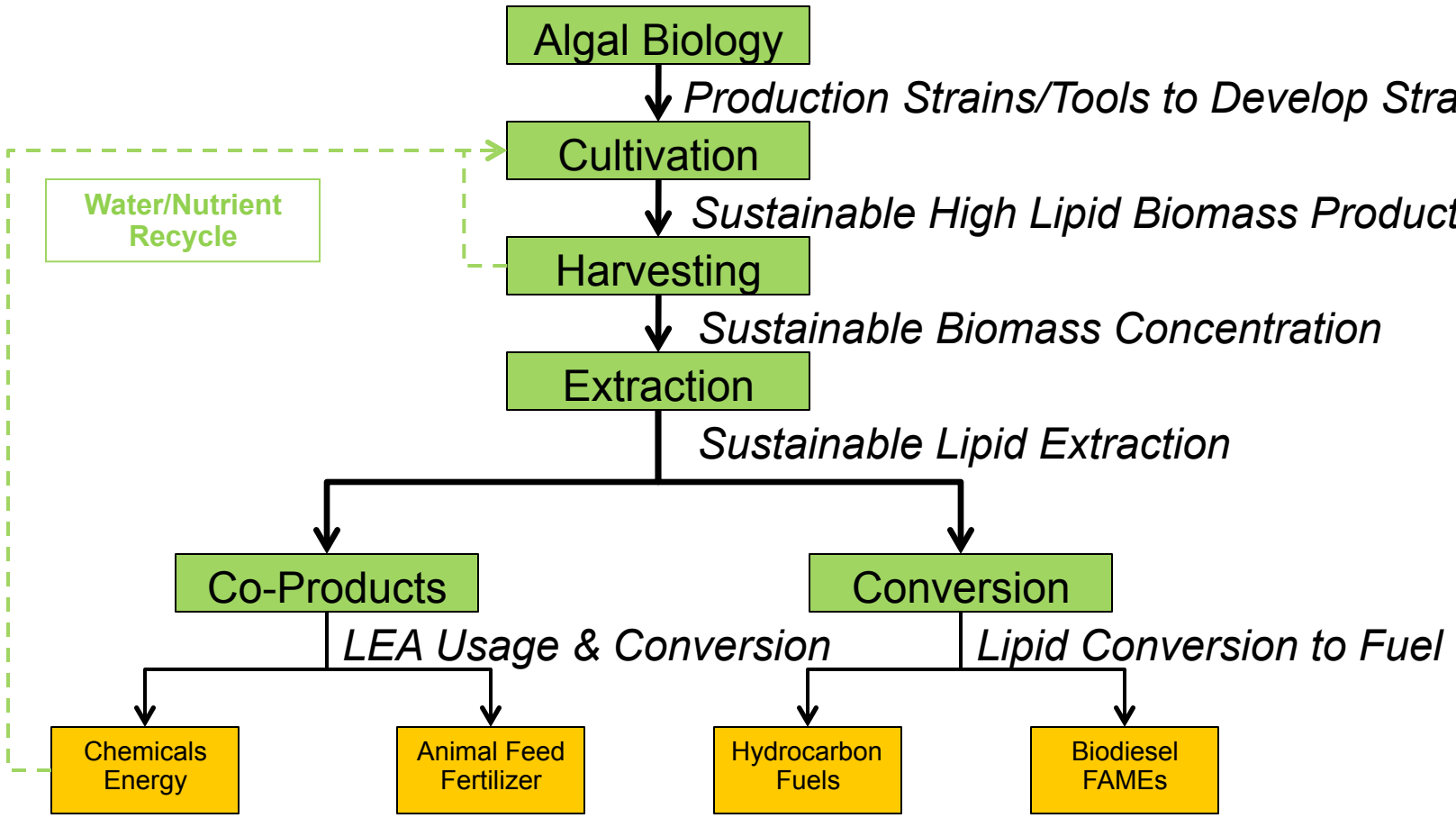
Relevance



NAABB has…

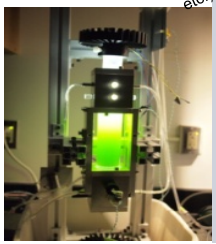
1. Provided a detailed resource assessment through the AISIM BAT Module
2. Brought five new strains through the value chain (including outdoor cultivation)
3. Demonstrated the ARID cultivation (heat management) and low nutrient cost
4. Evaluated three new harvesting systems at larger scale
5. Combined extraction with conversion technology to reduce cost and demonstrated with NAABB produced algae (with high and low lipid content)

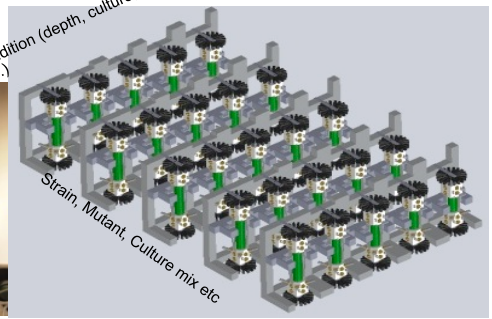
R&D Framework with High Level Outcomes



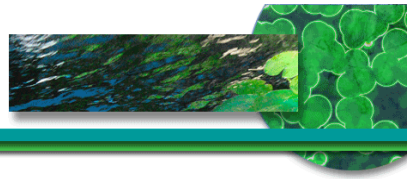
NAABB Accomplishments (as of May 5, 2013)

- **Over 150 presentations at national and international conferences**
- **>65 scientific publications**
- **Five theses**
- **New Journal: ALGAL RESEARCH (by Elsevier)**
- **New Conference Series: *International Conference on Algal Biomass, Biofuels and Bioproducts***
- **Deposited 30 most productive algae strains into UTEX culture collection**
- **33 Intellectual Property Disclosures**
  - Molecular biology tools – 10
  - Cultivation – 5
  - Harvesting and Extraction – 7
  - Fuel conversion – 8
  - Co-products and other – 3
- **New company: *Phenometrics***





Accelerating Algal Discoveries
Phenometrics



3rd International Conference on

Algal Biomass, Biofuels and Bioproducts

16 - 19 June, 2013 - The Sheraton Centre Toronto Hotel, Toronto, Canada

Supporting publication

Conference Chair

José A. Olivares

Los Alamos National Laboratory, Los Alamos, USA

Richard Sayre

Los Alamos National Laboratory, Los Alamos, USA

René Wijffels

Wageningen University, The Netherlands

Visit Journal home page:
www.elsevier.com/locate/algal

Visit conference website:
www.algalbbb.com

NAABB Agenda For Peer Review Meeting

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Click line to move to next presentation

ADDITIONAL BACKGROUND SLIDES

RESPONSES TO PREVIOUS REVIEWERS' COMMENTS

Response to Comments from the Peer Review (Held April 2011)

We want to thank the DOE for the opportunity to respond to the Peer Review Committee comments. We found that the comments reflected some very positive views that the NAABB program is making an impact, even this early on in the performance period. There were also a number of areas where the committee raised concerns or issues with our program. Since the Peer Review comments to our presentation were extensive and not organized in any logical manner, we have distilled and arranged these according to performance area, for ease in response and cohesiveness.

1.<u>All participants need to focus on the end goal of biofuel production, and it would likely be helpful for a project meeting to be held soon at Pecos to highlight the importance (and challenges) of scale.</u> Response: As the FOA for our proposal stated, the main NAABB program goals are the development of technologies for biofuels development. The FOA also required that our program add components necessary to develop all aspects of biomass generation and utilization, in order to increase the economic value of the overall biofuels development, such as would be implemented in a biorefinery system. Therefore, the bulk of our program leads to biofuels development from algal lipids and biomass, along with power generation, chemical and agricultural coproducts developed from lipid extracted biomass. We have had several face-to-face project meetings and many others, in which scale-up challenges have been a major topic. Similarly, our management team and several sets of investigators have travelled to Pecos and other production sites to review the process and understand the challenges. We will continue to do this and will take into consideration having a future overall program meeting at one of our large-scale facilities (e.g., Pecos).

2. <u>It appears to be yet another collection of individual researchers, each with their own expertise, collected from labs around the U.S., performing (or better yet selling their own research approach).</u> Response: The FOA for this program required the formation of a consortium with a broad representation from academia, industry and national laboratories. Therefore, our program was developed from this requirement. In forming our consortium we chose institutions that brought capabilities that were complimentary and appropriate across the developmental process for biofuels. We have assembled a team that has unique capabilities, yet is willing to work together to develop the NAABB objectives and goals.

Response to Comments from the Peer Review (Held April 2011)

3. **The follow-on slides simply looked like individual PI's sent along slides from their group and the PI massaged them together. Response:** The magnitude of the NAABB program makes it very challenging to put together a presentation for this type of review process. Therefore we strived at a 45-minute presentation that provides an overview of the NAABB framework, innovation, status, results, and strategy for the future. I most cases, when we presented innovation or results, we were faced with only the time to present a bullet, if at all presented. In some cases, we chose to provide a particular highlight of the scientific innovation and results from our program.
4. **This reviewer did not see a clear system of unit operations put in place up front, with specific objectives (and input and outputs for all) laid out, that the "team" had to develop. Response:** The NAABB program has over 70 individual task and subtask areas, within a very structured work break down schedule with milestones, deliverables, and decision points. These are contained within our Statement of Project Objectives and our Project Management Plan, as submitted and negotiated with DOE. A 45 minute presentation, at such a level of detail, would not have been possible or meaningful.
5. **Rapid down-selection with a ruthless application of common sense must be applied rapidly or this program will become too difficult to manage towards large scale commercial deployment. Response:** As pointed out several times during the presentation our program has incorporated a number of check points, assessments, and decision points for the processes and technologies being developed. The first of which are being implemented at months 12, 15, 18 and 24, in our program. These will generate a down-selection, rescoping, and/or refocusing for many of our processes.
6. **The real problem, of course, is that commercial production of microalgae is a farming endeavor, not something to be developed by intellectual academics who sit in research labs. Response:** Our goal is to make production of microalgae a farming endeavor that is: economical feasible, energetically positive, and environmentally sound. This is quite a goal and one that cannot happen without new scientific and technological breakthroughs. Additionally it certainly cannot happen without the underlying foundation and infrastructure to support such a farming endeavor, e.g., seed (algal strain) development, sound cultivation practices, economical harvesting, and process logistics. All of which are major components of the NAABB program.

Response to Comments from the Peer Review (Held April 2011)

7. **How does NAABB plan to monitor and assess progress by individual participants? Response:** NAABB is already monitoring progress in a number of ways, including: site visits by our project management team, monthly reports, financial and fiduciary reporting, face-to-face status reviews, monthly team meetings, bi-weekly meetings with team leads, and weekly meetings of our operations, executive team and DOE.
8. **This reviewer is concerned that the number of collaborations is far too big for a single PI to manage. Response:** As shown in the peer review presentation, our program structure provides for a thorough and very supportive management team that manages the day-to-day activities of NAABB. This includes three technical directors, 13 technical team leads, 2 operations managers, a full time project manager, an industry and intellectual property manager, and the full financial and subcontracting engine at Donald Danforth Plant Science Center. Without this structure, I would agree with the reviewer.
9. **How do they plan to disseminate information and the know-how resulting from this effort? I recommend the criterion of "peer-reviewed" publications and Gantt charts, as benchmarks. Are there metrics and milestones for each part of the NAABB effort? I recommend Gantt charts that are easy to read. Response:** As our supporting slides show, the NAABB investigators have already credited the NAABB program with over 20 manuscripts in print or under review in peer reviewed journals. We have also developed a website with regular highlights. We have an obligation to protect intellectual property, make it available first to our partners for licensing opportunities. Once this obligation is met, any IP not licensed is then made available to the general public through the innovating institution. Further, NAABB investigators have made over 100 presentations at national and international conferences. Our investigators have and are coordinating technical sessions at national conferences. Similarly, we are chairing and organizing an international conference in St. Louis later this year, in which many NAABB investigators will be presenting their work along with peers from the international community.
10. **Does the consortium plan to hold regular meetings, where all participants would present their progress? Response:** Yes, the consortium has already done this several times during the past year, and will continue to do this in the future. We tend to coordinate these events around other major national meetings.

Response to Comments from the Peer Review (Held April 2011)

11. **With $50M in funding, this project should produce algal biofuel. Will it be able to make timely changes in R&D so as to achieve that goal? Response:** We have staged a number of assessments, down-selects, and rescoping/refocusing processes across the lifetime of the program to achieve timely changes in R&D to achieve our goals and objectives. (Also, see response to #5 above)
12. **It was very difficult to see how this approach improves upon the most recent reports of Benneman and co-authors. Response:** The NAABB program uses the knowledge gathered in the Aquatic Species Program (ASP), by Benneman and others, as a starting point. For example, we utilize *Nannochloropsis salina* as one of our main production strains. Unfortunately, many of the other strains identified by the ASP have been lost and no longer available. Therefore, the NAABB prospecting efforts is helping continue to identify potential useful strains for cultivation. We also realize the technological advances that have occurred since the end of the ASP, for example, genomic and transcriptome sequencing capabilities have made it much easier to identify target genes for regulation and modification. Thus, the NAABB program is utilizing new high throughput sequencing and proteomics capabilities to advance our knowledge of algae and develop successful productive strains of algae. We are examining innovative ways to increase lipid production. This includes the identification of genes via systems biology and random mutagenesis approaches and developing tools to transform likely production strains with those candidate genes that prove helpful. Crop protection also falls under this area of increased lipid production by potentially decreasing down time due to crop failure, i.e., pond crashes.
13. **Strain selection needs more attention for disease resistance. Response:** As presented in the Peer Review, the NAABB program for strain selection flows into a cultivation pipeline that tests these strains in outdoor environments. This will provide screening for strain robustness against environmental factors such as predation, bacterial infections, etc. Our program also incorporates the development of technologies that will help provide resistance from such infections, through the addition of bacterial controlling substances and breakdown of biofilms produced by such organisms. Disease resistance is a good parameter to test and one we certainly keep in mind. Our initial selection is on growth and lipid productivity but we intend to put the best strains into a cultivation environment.

Response to Comments from the Peer Review (Held April 2011)

National Alliance For Advanced Biofuels and Bio-products

14. **The DNA sequencing effort of *Botryococcus braunii* was initiated by a group of interested (*Botryococcus* community) scientists and actually started by the JGI well ahead of the NAABB; IT IS INAPPROPRIATE for the NAABB to claim this as one of their efforts / accomplishment. Response:** We agree completely with the reviewer and stated during the presentation that this organism is currently being sequenced by JGI. We did not try to infer any prior involvement in this process by NAABB until our organization was formed. The community of scientists that provided the materials for the JGI sequencing program included a team of investigators from University of Arizona, Texas A&M, LANL, Northern Arizona University, and the University of Kentucky. Except for the last two institutions, the others are part of the NAABB *Botryococcus* program, and these investigators are currently working with JGI to finish the genomic sequencing of one of the strains, and annotating and mining the sequence information that has already been provided by JGI. The team of investigators is working towards understanding isoprenoid biosynthesis and development of these pathways into other species. Our NAABB team does include the *B. braunii* Race B genome and transcriptome (Andy Koppisch, LANL investigator) but of course this project was initiated by him and others before the formation of NAABB. We are also making an effort that focuses on converting the raw reads from the transcriptome sequencing into assembled isotigs that have been further analyzed (BLASTed and annotated. This work is currently being funded by NAABB).
15. **The strain selection process does not seem to be designed well. The slides state that either >300 or >500 stains, mostly collected from the environment, have already been screened. Why would any of these survive under cultivation conditions? The lab culturing conditions described do not recreate the main stressors of outdoor cultivation. The current methods seem to be brute-force only, not efficient, and not well thought out. Response:** We recognize the need for full testing of strains under outdoor cultivation conditions. Our strain selection approach is multi-phased with a high-throughput screen that selects strains in the lab for growth and lipid productivity. Those that make it through this initial test then are taken to outdoor pond environments for further evaluation of their characteristics and robustness. The phases are designed in this manner because beginning with high throughput screening in an outdoor environment would be resource constrained due to the large number of samples to be screened. Finally, to date we have isolated over 800 samples of algae, and screened over 400 in the lab for productivity. About 60 of these show excellent promise, and several of the strains are being tested in our small outdoor raceways. Stresses do need to be added to the second tier screening. (continued)

15. (Continued) We consider the efforts to be fairly efficient in using a combination of plating and FACS isolation of single algae. Selecting for ability to grow on solid and liquid media, exhibit reasonably fast growth rates in liquid culture and accumulate lipids are our first tier selections to quickly narrow down the field of candidates. Robustness in cultivation conditions is a good parameter to include. Perhaps a high light stress should be included in the first tier screening and we will discuss this with the PIs on these projects.

16. **A major lack in the presentation was evidence that the proponent have made quantitative projections on whether their suite of candidate technologies has the potential to meet the key technical challenges and the cost goals.** **Response**: This is certainly something we always have in mind in the Algal Biology and Algal Cultivation teams. As we identify promising genes in Algal Biology we will put them into model or production strains to test them against the baseline (parent strain). Our project on developing a pond-simulating photobioreactor that can be widely deployed across the NAABB will allow us to acquire standardized (comparable) rate and lipid productivity data from across the consortium that can be incorporated into our economic models.

17. Within our 15 and 18 month (June and September 2011) deliverables the NAABB program is set to generate the baseline cases along with a preliminary assessment of all of the quantitative parameters for our harvesting and conversion technologies in order to determine feasibility for technical success.

18. **The purpose of Solix PBR effort was not explained. Response:** The Solix Biosystems partnership is an important one for the consortium as they provide an excellent working process for commercial photobioreactors. This process will help us evaluate their feasibility in a number of applications, including the ability of PBRs to contain organisms along with issues of predatory and bacterial infections. With the recent placement of a Solix photobioreactor at NMSU, we will also be able to address a number of other issues associated with the best utilization of PBR's in algal cultivation. Solix is also providing biomass and lipid generated within their PBR system for the consortium partnership.

Response to Comments from the Peer Review (Held April 2011)

National Alliance For Advanced Biofuels and Bio-products

19. **The wastewater and produced water efforts were not well described. Response:** As explained above, our objective for this peer review was not to describe any technology in detail but to provide an overview that would fit within the allotted time period. The wastewater and produced water efforts within NAABB have as major objectives understanding the nutrient utilization and recycle of such waters, but most importantly the contamination issues and clean-up processes (specifically for produced waters) that would be required to make this important source of water usable in algal cultivation.
20. **Please be very specific about your energy balance....true and honest energy balances that track the unit energy consumed per unit energy extracted. Response:** We are in total agreement with the reviewer comments. For all of our harvesting and extraction processes we are developing a process flow model that determines all of the inputs and outputs both for mass balance and energy consumption and/or generation. These can then be converted to a cost analysis. The preliminary cost results presented for the LANL acoustic harvester represented the results from such a detailed analysis.
21. **Bioproducts of fuel include aquaculture feeds, which is very promising but what is the omega 3 FA content after lipid extraction, if any? Without this, the feed quality will be much less valuable. Response:** The NAABB focus remains on biofuels production. Therefore, if upstream processes extract or degrade the fatty acids left in the animal feed, this will affect its nutritional value. Thus, NAABB investigators are trying to determine the value of such feed. Obviously, there is a feedback loop, and if such high value components can be extracted and/or left in to add additional value to the feeds we will incorporate such processes.
22. **Why are pellets important as an achievement of NAABB? (paraphrased from the reviewer's comments)**
    Response: Delivering feed to an animal in a format that it will be consumed effectively is key to this industry. It increases handling characteristics. Not all potential feed materials pelletize easily (pelletizing distiller grains is currently a challenge for this industry) and in some cases additives need to be introduced in order to achieve practical formats. Achieving this can increase the value of feed by as much as $112 /ton.

Response to Comments from the Peer Review (Held April 2011)

23. **The animal feeding trials will require large quantities of biomass and presumably several years of effort. The lab-based animal digestion research described is indeed needed. If any actual animal feeding trials are executed, what value can be obtained given the limited research time available? Response:** The reviewer is correct, the requirement for large amounts of biomass is limiting NAABB's ability to carry out experiments on large animals. The timing is now getting critical and major decisions will be made within the next couple of months as to what animal studies move forward based on availability of biomass.
24. **Quantitative goals on net energy production and LCA issues were missing. Response:** In the time allotted all we could present were major goals and objectives, e.g., in slide two of the presentation. Nevertheless, the NAABB program does incorporate understanding net energy production through life cycle assessments on all processes that are carried forward. A comparison of these, can then be available to policy makers and industry for further decision making on viability of any one process.

PUBLICATIONS, DISCLOSURES AND PRESENTATIONS

NAABB Published Articles (as of 05/06/13)

Algal Biology

1. J.P. Barker, R.A. Cattolico, E. Gatza, Multiparametric analysis of microalgae for biofuels using flow cytometry, BD Biosciences (2012) http://www.bdbiosciences.com/br/instruments/accuri/articles/archive/2012_10/index.jsp
2. N. Bigelow, W. Hardin, J. Barker, A. MacRay, S. Ryken, R.A. Cattolico. A comprehensive GC-MS sub-microscale assay for fatty acids and its applications, Journal of the American Oil Chemists' Society 88 (2011) 1329-1338.
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19. P.M. Waller, R. Ryan, M. Kacira, P. Li, The algae raceway integrated design for optimal temperature management, Journal of Biomass and Bioenergy 46 (2012) 702-709.
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Conversion-Fuel

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Conversion-Fuel con't

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2. A. Koushik Pegallapati, “Internally Illuminated Photobioreactor for Microlagal Cultivation.” Ph.D. Dissertation, New Mexico State University, 2011.
3. J. Lu, , “Effects of Biofuel Policies on World Food Insecurity – A CGE Analysis.” J. W. Richardson Department of Agricultural Economics.” Ph.D. Dissertation, Texas A&M University, 2011.
4. M.L. Bartley, “Optimization of environmental parameters for microalga *Nannochloropsis salina* growth and lipid accumulation, and minimizing of invading organisms”. MSc Thesis, New Mexico State University, 2012.
5. D. A. Patterson, “Evaluation of whole and lipid-extracted algae meals (LEA) in the diet of juvenile red drum (*Sciaenops ocellatus*) and digestibility of LEA by red drum and hybrid striped bass (*Morone chrysops* x *Morone saxatilis*).” M.S. Thesis, Texas A&M University, 2013.

NAABB Invention Disclosures and Patent Applications (in Bold) as of 5/06/2013

	Disclosing Member	ID Number	Title
1.	CSU	09-051	Bioconversion Of Extracted Algal Biomass Into Fuels And Other Chemicals
2.	Danforth	DDPSC0017	Developing A Transgenic Photosynthetic Organism That Can Auto-Regulate Its Light Harvesting Antenna Size
3.	Danforth	DDPSC0019	Exposure To Decane Leads To Oil Induction In Algae At Single Cell And Autospore Stages
4.	El Dorado		Methods And Apparatus For Forced Genetic Adaptation And Commercial Scale Growth Of Algae In Challenged Water As Well As A System For Algae-Based Treatment Of Challenged Water
5.	**El Dorado**	**US Provisional**	**Method And Apparatus For Greenhouse Gas Regulation Using Algae To Create A Strategic Algae Reserve Energy Supply**
6.	**Genifuel**	**Patent # US7,905,930 B2**	**Two-Stage Process For Producing Oil From Microalgae**
7.	Genifuel	USPTO12/683369	Closed-Loop System For Growth Of Aquatic Biomass And Gasification Thereof
8.	ISU		Selective Absorption Of Tocopherol By Pentafluorophenyl-Functionalized Mesoporous Silica Nanoparticles
9.	LANL	S121847	Identification And Creation Of Algal Strains For The Purpose Of Drop-In Transportation Fuels: *Tetraselmis Sp*. Lanl1001 And Others
10	LANL	S129149	Isolation Of A High Lipid-Content Subpopulation Of *Nannochloris Sp*
11.	LANL	129180	Facile Isotopic Synthesis Of Isoprenoid Precursors

NAABB Invention Disclosures and Patent Applications (in Bold) as of 5/06/2013

	Disclosing Member	ID Number	Title
12.	**LANL**	**S121345 US No. 13/652,296 10/15/12**	**Method And Apparatus For Acoustically Manipulating Biological Particles**
13.	LANL	S129415	Hydrogel-Based Integrated Environments For Microalgae Cultivation
14.	LANL	S129181	Functionalization Of Sialic Acid: Odorant Derivatives And Adsorbtion/Attachment To Natural And /Or Man Made Surfaces
15.	LANL	S121085	Reverse-Flow Submerged Forward Osmosis For Clean Water Recharge To Algae Raceway Systems
16.	LANL	S129406	Optical-Driven Emulsion Destabilization
17.	LANL	S129598	Acoustic-Driven Emulsion Destabilization
18	MSU	TEC2011-0021	Photobioreactor/Sensor Array
19.	NMSU		Extractive Conversion Of Wet Algae To Biodiesel Under Supercritical Methanol Conditions
20.	NMSU		Extractive Conversion Of Dry Algae To Biodiesel Under Microwave Irradiation
21.	PNNL/ Genifuel	17184	Sulfate Removal From Hydrothermal Environment
22..	TAMU	3273	Solvent-Phase Extraction Of Algal Oils Via Surface Functionalized Migration Of Algal Cells From Aqueous-Phase To Solvent-Phase

NAABB Invention Disclosures and Patent Applications (in Bold) as of 5/06/2013

	Disclosing Member	ID Number	Title
23.	TAMU	3379	Production Of High-Quality Bio-Oil, Bio-Char And Synthesis Gas From Microalgae Using Pressure Reactor And The TAU Fluidized-Bed Pyrolyzer
24.	TAMU	3521	Metabolic Engineering Of Algae For Aviation Fuel Production
25,	TAMU	3333	Agrobacterium And Glass Beads-Based Transformation Of Different Green Algae Strains
26	Targeted Growth	TARG-022_00US	Modified Photosynthetic Micro-Organisms For Continuous Production Of Carbon-Based Products
27.	Targeted Growth	TARG -022_01US	Modified Photosynthetic Micro-Organisms For Continuous Production Of Carbon-Containing Products
28	Targeted Growth	TARG -023_00US	Modified Diacylglycerol Acyltransferase Proteins And Methods Of Use Thereof
29.	**UOP**	**H0031677 US 12/14/11; PCT 9/5/12**	**Comparison Of Metals And Phosphorous Removal Of Crude Algae Oil Extracts Using Acid Washing Alone And In Combination With Base And Water Washing**
30.	UOP	H0036528	Removal Of Metals From Algal Oil By Acid Washing And Combined Base/Acid Washing
31.	UOP	H0037456	Production Of Large Molecular Weight Paraffinic Waxes From Hydroprocessing Of Algal Oils
32.	UOP	H0037780	Removal Of Chloride From Triglyceride Oils Using A Combination Of Hot Base And Acid Washing
33.	WUSTL		Method For Obtaining Buoyant Triacylglycerol-Filled *Chlamydomonas reinhardtil*

NAABB Highlights

- **NAABB Researchers Integrate Algae Genome Data in New Web-based Tool ,** http://www.naabb.org/images/Technical/Vol%201_No%201_Nov1-2010.pdf
- **NAABB Industry Member Catilin Generates Biodiesel from Algal Oil ,** http://www.naabb.org/images/Technical/Vol%201_No%202_Nov8-2010_web.pdf
- **NAABB researcher, Dr. Rose Ann Cattolico of University of Washington, sets new standard for measuring algal lipids** http://www.naabb.org/images/Technical/Vol%201_No%203_Nov15-2010%20final.pdf
- **NAABB researcher, Dr. Shuguang Deng of New Mexico State University, directly converts algal biomass to biodiesel** http://www.naabb.org/images/Technical/Vol%201_No%205_Nov29-2010%20final.pdf
- **NAABB industry partner, HR Biopetroleum, obtains approvals to begin project** http://www.naabb.org/images/stories/Vol_1_No_6_Dec6-2010_final.pdf
- **NAABB spearheads broad collaboration on economics models for algal fuels** http://www.naabb.org/images/stories/Vol_1_No_8_Jan17-2011.pdf
- **NAABB Researchers Complete Sequence of Two Algal Genomes** http://www.naabb.org/images/stories/Vol_1_No_9_Mar21-2011.pdf
- **NAABB Researcher, Pete Silks, of Los Alamos National Laboratory, Develops Process for Converting Algal Oil to Alternative Aviation Fuel** http://www.naabb.org/images/stories/Vol_1_No_10_Mar21-2011.pdf
- **Researching the genetics of B. braunii microalga, a potential renewable biofuel source**
- **A first use of oil and gas produced water as a medium for algae grown for biofuel production-pilot scale testing**
- **Michigan State University's Algal Photo Bioreactor Licensed by Phenometrics, Inc.**

NAABB Presentations

National Alliance For Advanced Biofuels and Bio-products

Catilin

- Sams, Sept 28-30, 2010 ABO Summit in Phoenix, AZ - Title: Conversion of Algal Oil to Biodiesel Via Transesterification
- Sams, Nov 2-3, 2010 NBB Technical Workshop in Kansas City, MO - Titles: Mesoporous Nanoparticles for Selective Sequestration of Chemicals from Microalgae and Biodiesel Production via Heterogeneous Transesterification
- Sams, Feb 7-9, 2011 NBB Conference in Phoenix, AZ - Title: Biodiesel Production via Heterogeneous Transesterification

Donald Danforth Plant Science Center

- Sayre RT (2011) Algal biofuels, a systems approach; Keystone Symposium on Biofuels, Singapore
- Sayre RT (2011) Algal biofuels; Dept. Biochemistry, University of Nebraska, Lincoln, NE
- Sayre RT (2011) Algal biofuels and biomass production. Los Alamos National Labs, NM
- Sayre RT (2010) National Alliance for Algal Biofuels and Bioproducts. DOE; Public Meeting of the Biomass Research and Development Technical Advisory Committee. Washington, DC.
- Sayre RT (2010) Algal biofuels, the state of the industry. St Louis on the Air, November 29, 2010, local affiliate.
- Sayre RT (2010) Benefits and risks of microalgal biofuels. 11th International Symposium on the Biosafety of Genetically Modified Organisms. Buenos Aires, Argentina.
- Sayre RT (2010) Algae-the biofuel of the future. Global Agtech Investors Network, St Louis, MO.
- Sayre RT (2010) Algal biofuel systems. Department of Plant Biology, University of Arizona, Tucson.
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- Sayre RT (2010) Microalgal Biofuels. 2nd Pan American Congress on Plants and BioEnergy. Sao Paulo, Brazil.
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- Sayre RT (2010) Microalgal biofuels; a systems approach. Growmark Conference, St Louis.
- Sayre RT (2010) Renewable Biofuels. Huazhong Univ. Wuhan, China.
- Sayre RT (2010) Microalgal biofuels; a systems approach. International Applied Plant Biotechnology Conference. St Louis.
- Sayre RT (2010) Microalgal Biofuels Panel Session; Ag Innovation Showcase, BRDG Park, St Louis.
- Sayre RT (2010) Science Friday, Biofuels; April 30, 2010; http://www.sciencefriday.com/program/archives/201004305

Genifuel

- Oyler, September 2010 Algal Biomass Organization (ABO) Summit in Phoenix, AZ - Title: CHG: Today's Lowest-Cost Biofuel Process.
- Oyler, January 2011 Pacific West Biomass Conference in Seattle, WA - Title: CHG: A Major Source of Renewable Energy

NAABB Presentations

National Alliance For Advanced Biofuels and Bio-products

Iowa State University

- Trewyn, March 31, 2011 241st American Chemical Society Meeting in Anaheim, CA

Los Alamos National Laboratory

- Silks, L.A (Pete); Jan. 21, 2010 San Diego State University at the Department of Chemistry – Title: Catalyzed Conversion of Non-Food Biomass to Fuels and Chemicals: Use of Algal and Carbohydrate Feedstocks
- Olivares, JA; March 22, 2010 Global Energy Summit in Colorado Springs, CO – Title: Overview of the NAABB Algal Biofuels Efforts
- Olivares, JA; March 30-31, 2010 Biomass 2010 in Washington D.C. – Title: NAABB: An Algal Biofuels Consortium
- Olivares, JA; April 13-14, 2010 Southwest Biofuels Policy Summit in Pojoaque, NM – Title: Overview of the NAABB Algal Biofuels Efforts
- Marrone, B.; April 2010 Southwest Biofuels Policy Summit in Albuquerque, NM – Title: Flow Cytometry Technology Applied to the Characterization and Optimization of Algal Cells for Biofuel Production
- Marrone, B.; May 2010 XXV Congress of the International Society for Advancement of Cytometry in Seattle, WA – Title: Flow Cytometry Technology Applied to the Characterization and Optimization of Algal Cells for Biofuel Production
- Olivares, JA; May 3, 2010 Center for Process Analytical Chemistry in Seattle, WA – Title: Process Instrumentation Needs for the Biofuels Industry
- Silks, L.A (Pete); May 23-25, 2011 Algae World Summit 2011 in San Diego, CA – Title: Catalyzed Conversion of Non-Food Biomass to Fuels and Chemicals: Use of Algal Lipids and Carbohydrate Feedstock
- Olivares, JA; May 24, 2010 AgShowcase in St. Louis, MO – Title: Overview of the NAABB Algal Biofuels Efforts
- Olivares, JA; June 3, 2010 Re-Energize America Conference at NMSU – Title: Overview of the NAABB Algal Biofuels Efforts
- Olivares, JA; June 14, 2010 STEPS Workshop at UC Davis – Title: Overview of the NAABB Algal Biofuels Efforts
- Olivares, JA; June 15, 2010 NASA at the Ames Laboratory – Title: Overview of the NAABB Algal Biofuels Efforts
- Olivares, JA; June 24, 2010 AIST in Tsakuba, Japan – Title: Brief on NAABB Algal Biofuels Efforts
- Olivares, JA; June 25, 2010 NEDO in Tokyo, Japan – Title: Brief on NAABB Algal Biofuels Efforts
- Olivares, JA; June 28-29, 2010 Qingdao Institute for BioEnergy and BioTechnology in Qingdao, China – Title: Overview of the LANL Biofuels program and NAABB overall program
- Olivares, JA; August 18-20, 2010 Topsoe Catalysis Forum in North Zealand, DN – Title: Status and Prospects of Microalgae as a Source of Renewable Fuels
- Silks, September 2010 ABO Algae Biofuels Summit in Phoenix, AZ – Title: Chemical Conversion: From Transportation Fuels to Chemical Feedstocks

NAABB Presentations

Los Alamos National Laboratory continued

- Olivares, JA; October 5, 2010 Algal Biology and Biotechnology Summit in Phoenix, AZ – Title: Challenges in Algal Biofuels Development
- Olivares, JA; October 14-16, 2010 Biomass South 2010 in Memphis, TN – Title: Policy Issues for Algal Biofuels
- Olivares, JA; November 4-5, 2010 Military Energy and Alternative Fuels Conference in Alexandria, VA – Title: Initiatives in Algal Biofuels Development
- Olivares, JA; December 13-14, 2010 Asia-Oceania Algae Innovation Summit in Tsukuba, Japan – Title: NAABB: An Algal Biofuels Consortium
- Koppisch, A.; December 17, 2010 International Chemical Congress of Pacific Basin Societies (Pacifichem), Materials Chemistry Section #538 in Honolulu, HI – Title: Extraction of organics and metals with hydrophobic ionic liquids
- Koppisch, A.; December 18, 2010 International Chemical Congress of Pacific Basin Societies (Pacifichem), Materials Chemistry Section #817 in Honolulu, HI – Title: Tetraalkylphosphonium-based ionic liquids for dye extraction and ionization of small-molecule MALDI analytes
- Olivares, JA; January 18-19, 2011 Biofuels for the Aviation Industry, NRC Canada Workshop in Halifax, Nova Scotia – Title: NAABB: An Algal Biofuels Consortium
- Olivares, JA; February 7, 2011 National Biodiesel Board in Phoenix, AZ – Title: Challenges and Opportunities in Algal Biodiesel Development
- Koppisch, A.; February 14, 2011 Northern Arizona University in Flagstaff, AZ – Titles: Bacterial Iron Acquisition and Homeostasis: The Key Role of the Metal in the Bacterial Life Cycle and Research Applications in Sustainable Fuels, Materials and Health Sciences
- Olivares, JA; March 2011 Reliance Industries Limited in Mumbai, India – Title: NAABB: An Algal Biofuels Consortium
- Silks, LA (Pete); March 1-6, 2011 Keystone Biofuels meeting in Singapore, Malaysia – Title: Chemical Conversion: From Transportation Fuels to Chemical Feedstocks

New Mexico State University

- Ketheesan and Khandan, Aug 20-22, 2010 International Conference on Biomass and Energy Technologies (ICBT) in Beijing, China – Title: Air-lift driven raceway bioreactor for microalgae production
- Pegallapati and Khandan, Aug 20-22, 2010 International Conference on Biomass and Energy Technologies (ICBT), Beijing, China – Title: Optimization of algal photobioreactor for biodiesel production

NAABB Presentations

National Alliance For Advanced Biofuels and Bio-products

New Mexico State University continued

- Khandan, Aug 20-22, 2010 International Conference on Biomass and Energy Technologies (ICBT), Beijing, China – Title: Microalgae as a Sustainable Source of Energy
- October 2010 New Mexico State University Department of Biology - Seminar talk that included discussion of algal biofuel research
- December 2010 Scripps Institution Oceanography in San Diego, CA - Seminar talk that included discussion of algal biofuel research
- Patil, P.; Gude, V.; Mannarswamy, A; Deng, S.; Cooke, P.; Munson-McGee, S.; Lammers, P.; Rhodes, I.; Nirmalakhandan, N. "Direct Conversion of Wet Algal Biomass Under Supercritical Methanol Conditions" Paper 679g, Presented in AIChE Annual Meeting, Salt Lake City, Utah, Nov. 7-12, 2010.
- Patil, P.; Gude, V.; Mannarswamy, A; Deng, S.; Cooke, P. "Optimization of Microwave Assisted Catalytical Transesterification of Dry Algae Biomass to Biodiesel" Paper 519b, Presented in AIChE annual meeting, Salt Lake City, Utah, Nov. 7-12, 2010.
- P. Patil, V Gude, A. Mannarswamy, P. Lammersb, I. Rhodes, N. Khandan, S. Deng "Direct Conversion of Wet Algae to Biodiesel under Supercritical Methanol Conditions" Presented in the International Conference on Biomass Energy Technologies, Beijing, China, August 20-23, 2010.
- Characterization of Algal Biofuel and Feedstocks, F. Omar Holguin, Uriel Ortega, Tanner M. Schaub. Oral Presentation accepted 2/14/11 ASMS Conference on Mass Spectrometry and Allied Topics June 5 - 9, 2011 Colorado Convention Center, Denver, CO. Log number 2504
- Unc, A. 2010. Algae Production for Oil, Departmental and University Series Seminar, Feb. 11, Las Cruces, NM
- Bonde, N, Gregson, J, Unc, A. 2011 Antibiotic resistance of E. coli in a wastewater collection, treatment and algal growth system. American Society of Microbiology meeting, New Orleans, LA, May 20-25
- Nalim, FA, Gregson, J and Unc, A. 2011. Impact of Nannochloropsis salina on the diversity of wastewater bacteria. 4th Congress of European Microbiologists, Geneva, Switzerland, June 21-25

Pacific Northwest National Laboratory

- Canfield NL, and W Liu. 2011. "Progression of Fabrication Techniques and Thin Porous Metal Sheets as Membrane for Support." Abstract submitted to North American Membrane Society 2011, Las Vegas, NV. PNNL-SA-78037.
- Liu W, WA Wilcox, and XS Li. 2011. "Novel Membrane Technologies for Harvesting of Micro-Algae ." Abstract submitted to North American Membrane Society (NAMES) 2011 Annual Meeting, Las Vegas, NV. PNNL-SA-78041.

NAABB Presentations

Pacific Northwest National Laboratory continued

- Canfield NL, and W Liu. 2011. "Progression of Fabrication Techniques and Thin Porous Metal Sheets as Membrane for Support." Abstract submitted to North American Membrane Society 2011, Las Vegas, NV. PNNL-SA-78037.
- Li XS, WA Wilcox, Y Rao, NL Canfield, and W Liu. 2011. "Surface Modification of Porous Metallic Sheet." Abstract submitted to 21st Annual Meeting of the North American Membrane Society, Las Vegas, NV. PNNL-SA-78426.
- November 11, 2010 “Catalytic Hydrothermal Gasification of Algae" was presented at the AIChE national meeting in Salt Lake City, Utah by Doug Elliott
- Liu W. 2010. "Ceramic/Porous Metal Sheet Membranes for Biomass Conversion to Fuels." Presented by Wei Liu (Invited Speaker) at 11th International Conference of Inorganic Membranes and North American Membrane Society 2010 Annual Meeting, Washington, DC on July 22, 2010.
- Liu W. 2010. "Membrane Filtration and Separation for Water Reuse in Fuel Production From Biomass - Algae Production." Presented by Wei Liu (Invited Speaker) at AIChE Annual Meeting, Salt Lake City, UT on November 8, 2010.
- Holladay, Dec 15, 2010, NAABB Overview to the DOE EERE Technical Advisory Council, Washington, DC
- Holladay, Sept 2010, Next Generation Fuels from Algae, to ENN, Langfang, China
- Holladay, Sept 2010, Advanced fuels from biomass, to Qingdao Institute of Bioenergy and Bioprocess Technologies, Qingdao, China
- Holladay, New Routes to Fuels from Algal Biomass– China Information Exchange and Collaborative Analysis, to the Sino-US Biofuels MOU Cooperation Working Group Meeting , Sept 10, 2010, Beijing, China
- Holladay, Micro and Macro Algal Routes to Fuels, to the National Research Council, Canada, Nova Scotia,Canada, March 2010

Solix Biofuels

- Lammers, October 8, 2010 QIBEBT Symposium on Algae for Energy at the Chinese Academy of Sciences in China – Title: Lipid analysis of oil-producing microalgae
- Lammers, October 11, 2010 East China University of Science and Technology in Shanghai, China – Title: Growth and Lipidomics Characterization of Nannochloropsis salina for Biofuels
- Lammers, March 7, 2011 Indian Institute of Science, Department of Biochemistry in Bangalore, India – Title: Algal Biomass and Lipidomics Research at New Mexico State University
- March 22-24, 2011 DOE Joint Genome Institute Meeting: Genomics of Energy & Environment – Title: Characterization of the bacterial metagenome in an industrial algae bioenergy production system

NAABB Presentations

Terrabon LLC

- Granda, June 27-30, 2010 World Congress on Industrial Biotechnology and Bioprocessing in Washington DC – Title: Ensuring Sustainability and Economic Viability of Algae Biofuels through the Efficient Utilization of Algae Biomass In: Algae and Feedstock Crops – Key Technological Breakthroughs in the Development of Algae-based Energy Solutions
- Granda, September 28-30, 2010 Algae Biomass Summit in Phoenix AZ – Title: Attaining Sustainable and Economically Viable Algae Biofuels through the Efficient Utilization of Algae Biomass In: Commercial Track – Building the Algae Industry

Texas AgriLife Research

- Richardson, Outlaw, and Fischer, April 13-14, 2010 Annual Southwestern Biofuels Summit in Albuquerque, NM – Title: Potential Animal Feed Demand and Prices for Algae By-products
- Samarasinghe, and Fernando, June 20-23, 2010 ASABE Annual General Meeting in Pittsburgh, PA – Title: Effect of Pressure Shock on Mirco-algal cell lysis
- Thomasson, Sui, Yao, and Ge, June 20-23, 2010 ASABE Annual General Meeting, Pittsburgh, PA – Title: Toward On-line Measurement of Algal Properties
- Bryant, Lu, Richardson, and Outlaw, July 25-27, 2010 Agricultural and Applied Economics Association Annual Meeting in Denver, CO – Title: Long-Term Effects of U.S. Renewable Fuel Standard on World Hunger
- Devarenne, August 2010 Plant Sciences Program at University of Arizona
- Devarenne, October 2010 Federation of Analytical Chemistry and Spectroscopy (FACSS) – Title: Raman Microscopy and Imaging Symposium
- Davis, Garzon, Lacey, and Nikolov, Sept 28-30, 2010 Algae Biomass Submit in Phoenix, AZ – Title: Harvesting Algae by Ionic Coagulation
- Devarenne, September 2010 Department of Plant Sciences at University of Kentucky
- Richardson, Fischer, Allison, and Outlaw, September 28, 2010 Algae Biomass Summit in Phoenix, AZ – Title: What Will it Take to Make Algae Biofuels Profitable?
- Murdock, Luedecke, Lassig, Emsoff, Stepp, Davis, Lacey, and Nikolov, September 28-30, 2010 Algae Biomass Summit in Phoenix, AZ – Title: Low cost, low energy methods of dewatering microalgal cultures: A comparison of electrolytic methods
- Samocha and Wilkenfeld, November 1, 2010 Texas AgriLife Research Bioenergy Initiative Program Mini-Conference, Corpus Christi, TX – Title: Production of Algae Biomass in Corpus Christi, TX
- Devarenne, February 2011Department of Biochemistry at Indiana University

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Texas AgriLife Research continued

- Billuri and Bonner, February 4, 2011 Institute for a Sustainable Environment at Clarkson University – Title: Technology Development to Optimize Algal Derived Biofuel
- Fischer, Richardson, Outlaw, and Allison, February 5-8, 2011 - Southern Agricultural Economics Association Meeting in Corpus Christi, TX – Title: Economic Feasibility of Commercial Algae Oil Production in the U.S.
- Richardson, February 15, 2011 Pre-Congress Seminar Developing Algae Biofuels by F.O. Lichts in London – Title: Assessing the Economic Success for Algae Farms Under Alternative Assumptions for Strain Selection, Cultivation, Harvesting and Extraction.
- Richardson, February 16-17, 2011 Next Generation Biofuels 2011 by F.O. Lichts in London – Title: Outlook for Algae as a Feedstock for Biodiesel Production
- Samocha and Wilkenfeld, March 15, 2011 Texas AgriLife Research Bioenergy Initiative Program Mini-Conference, Corpus Christi, TX – Title: Use of an Experimental Outdoor Raceway System for Microalgae Production
- Richardson and Fischer, March 24-25, 2011 Berkeley Bioeconomy Conference, The State of Biofuel and Biotechnology at the M.C. Berkeley Alumni House – Title: Economics of Algae for Biofuels
- Thomasson, J.A., R. Sui, Y. Yao, and Y. Ge. 2010. Toward On-line Measurement of Algal Properties. ASABE Paper No. 1009359. St. Joseph, Mich.: ASABE.
- Fox, J. M., A. L. Lawrence, P. V. Zimba. Use of Algae Co-Products as Feed Ingredients in Aquaculture Feeds. Book of Abstracts (CD-ROM), World Aquaculture Society Annual Conference. New Orleans, Louisiana. USA. pp. 158. February 28 - March 03, 2011.

University of Arizona

- Ogden, March 2010 League of Women Voters in Green Valley – Title: Algal biofuels and bioproducts
- Ogden and Ren, March 2010 SW Biofuels Meeting in Albuquerque, NM – Title: Effects of Nitrogen Source and Cultivation Conditions on Growth Rate and Lipid Production in Nannochloropsis gaditana
- Ogden, May 18-19, 2010 Algae World Summit in San Diego, CA – Title: NAABB overview for Algae Production
- Ogden, September 28, 2010 Society of Biological Engineers Webinar – Title: Algae to Bioproducts and Biofuels, Challenges and Promising Technologies
- Ogden, October 19, 2010 University & Industry Consortium Meeting in St. Louis, MO – Title: Algal Biofuels Research- Engineering Challenges
- Ogden and Ren, November 2010 AIChE Annual Meeting in Salt Lake City, UT – Title: Maximizing productivity in batch reactors of microalgae Nannochloropsis Gaditana

NAABB Presentations

University of California Los Angeles

- April 5, 2010 Keystone Symposia on Biofuels in Singapore - Title: RNA-Seq Analysis of the Chlamydomonas Transcriptome Under Nutrient Limitation
- April 19, 2010 Waller Memorial Lecture at Ohio State University - Title: TAG, you're it! Basic science for algal biofuels.
- Oct 5, 2010 Algal Biology Symposium in Lincoln, NE - Title: Use of next gen sequencing approaches to characterize TAG accumulation in Chlamydomonas
- September 2010 Algal Biomass Organization in Phoenix, AZ – Title: Computational algal genomics
- November 10, 2010 American Institute of Chemical Engineers (AIChE) Annual Meeting in Salt Lake City, UT. - Title: Transcriptome Analysis of Chlamydomonas reinhardtii During Nitrogen Starvation Using RNAseq
- December 2010 Scripps Oceanographic Institute in San Diego, CA – Title: Computational algal genomics
- February 2, 2011 UC Riverside in Riverside, CA - Title: Desperately Seq-ing N: Analysis of the Chlamydomonas transcriptome for TAG accumulation
- February 10, 2011 Colorado State University in Fort Collins, CO - Title: Algae Derived Biofuel: A Systems Biology Approach
- February 22, 2011 University of Notre Dame at Notre Dame in Indiana - Title: TAG, you're it! Using flux analysis and transcriptomics to identify key steps in triacylglycerol accumulation

NAABB Presentations have not been tracked since March 2011 due to the large volume and inability to keep up with changes

NAABB Organized Meetings/Sessions

- **2010 Algae Biomass Summit.** Phoenix, AZ; Sept. 2010.
  - Session: Analysis, Renewability, and Life Cycle Assessment
    Co-Chairs: Meghan Starbuck, New Mexico State University and Ron Pate, Sandia National Laboratories
  - Session: Conversion of Algal Biomass and Lipids into Practical Fuels
    Chair – Anthony Marchese, Colorado State University

- **1st International Conference on Algal Biomass, Biofuels, and Bioproducts.**
  St. Louis, MO; July 17-21, 2011.
  - *Conference Co-chairs: Richard S. Sayre, The Donald Danforth Plant Science Center; and José A. Olivares, Los Alamos National Laboratory*

- **242nd American Chemical Society.** Denver, CO Aug. 28th – Sept. 1st, 2011.
  - Symposium: Recycling Carbon: Catalyzed Conversion of Non-Food Biomass to Fuels and Chemicals
    - Sponsored by the Division of Industrial and Engineering Chemistry
    - *Co-Chairs: John C. Gordon, Los Alamos National Laboratory; George Kraus, Iowa State University; L.A. "Pete" Silks, Los Alamos National Laboratory; Ryan West, Procter and Gamble*

- **2nd International Conference on Algal Biomass, Biofuels, and Bioproducts.**
  San Diego, CA; June 10-13, 2012.
  - *Conference Co-chairs: Richard S. Sayre, The Donald Danforth Plant Science Center; and José A. Olivares, Los Alamos National Laboratory*