

# **Introduction to the Proceedings of the Twenty-Eighth Symposium on Biotechnology for Fuels and Chemicals**

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The Twenty-Eighth Symposium on Biotechnology for Fuels and Chemicals was held April 30-May 3, 2006 in Nashville, Tennessee which provided a new interesting venue as well as a convenient travel destination. The growing interest in alternative fuels and chemicals, driven in part by the rising cost of petroleum, along with the exciting technical program yielded a record attendance at this Symposium with 479 participants, exceeding late year's record attendance in Denver. Notable was a dramatic increase in representation from industry which comprised about 40% of the attendees, signifying the continuing transition of Symposium from biomass research to inclusion of commercial development and deployment. The Symposium continued to receive strong international support with 30% of the attendees coming from 24 countries. As always, the Symposium was a strong supporter of education as shown by the 86 students registered for the meeting at the reduced rate.

The 2006 28<sup>th</sup> Symposium on Biotechnology for Fuels and Chemicals marked a transition from a meeting organized and managed by the National Renewable Energy Laboratory and the Oak Ridge National Laboratory to transferring these critical duties to a professional not-for-profit scientific society, the Society for Industrial Microbiology (SIM). SIM took on the responsibility for contracting with the host hotel, handling registration, abstract submission and tracking, proceedings publication and overall management of the meeting. The technical aspects continue to be managed by the 21 member organizing committee whose responsibility is to support the meeting Co-Chairs. Session selection, abstract review, manuscript review and editing and proceedings editing is handled by the meeting Co-Chairs and overseen by the committee as it has been in previous years. This transition went very smoothly and the meeting was managed quite well by SIM even in the face of the record attendance.

Selection of the Charles D. Scott awardees marked a small but appropriate departure from tradition with selection of two equally deserving individuals based upon their significant, lengthy support of the Symposium both through their technical contribution for bioenergy research and also by their serving tirelessly as Co-Chairs for the Symposium for ten to twelve years! Brian Davison from Oak Ridge National Laboratory (ORNL) is the Chief Scientist for Systems Biology and Biotechnology. In his twenty years at ORNL he has performed biotechnology research in variety of areas including bioconversion of renewable resources, non-aqueous biocatalysis, systems analysis of microbes, and immobilization of microbes and enzymes among other areas of research. He supported the Symposium many ways before becoming co-chair of the 15<sup>th</sup> to 26<sup>th</sup> Symposium on Biotechnology for Fuels and Chemicals and served as editor of Proceedings in *Appl. Biochem. Biotechnol.*, (1994–2005). The Symposium grew from 150 to over 400 attendees during these twelve years (ten with Mark Finkelstein).

Mark Finkelstein joined the National Renewable Energy Laboratory (NREL) in 1992 to introduce industrial approaches to problem solving and helped establish numerous successful business relationships during his tenure at NREL. He helped initiate work on *Zymomonas* within the Biofuels Program that resulted in numerous patents, publications, NREL's first team Staff Award, and an R&D 100 award in 1995. He has served in a variety of capacities in support of the Symposium on Biotechnology for Fuels and Chemicals before becoming co-chair from 1996 to 2004. In 2004 Mark joined Luca Technologies, a small biotechnology company using microbes to create *in-situ* hydrogen/methane as a new source of energy. The Symposium on Biotechnology for Fuels and Chemicals congratulates both Brian and Mark for receiving the CD Scott Award in 2006.

These proceeding cover many of the 62 oral presentations and 255 poster presentations covering topics ranging from Feedstock Supply and Logistics, Microbial Catalysts and Metabolic Engineering, to Bioprocessing and Separations R&D, and Bio/Thermo-chemical Integrated Biorefinery. In addition, the Symposium hosted two special sessions on Life Cycle Analysis/Sustainability, and International Biomass/Biofuels Update.

### Session Chairpersons

#### ***Session 1A: Enzyme Catalysis and Engineering***

Chairs: Michael Himmel, *National Renewable Energy Laboratory, Golden, CO*  
Elena Vlasenko, *Novozymes, Inc., Davis, CA*

#### ***Session 1B: Plant Biotechnology and Genomics***

Chairs: Mariam Sticklen, *Michigan State University, East Lansing, MI*  
Gerald Tuskan, *Oak Ridge National Laboratory, Oak Ridge, TN*

**Session 2: Biomass Fractionation and Hydrolysis**

Chairs: Amy Miranda, *USDOE Office of the Biomass Program, Washington, DC*  
Charles Wyman, *University of California, Davis, CA*

**Session 3A: New and Developing Industrial Bioproducts**

Chairs: Mohammed Moniruzzaman, *BioEnergy Intl. LLC, Norwell, MA*  
Christian Stevens, *Ghent University, Gent, Belgium*

**Session 3B: Feedstock Supply and Logistics**

Chairs: Robert Perlack, *Oak Ridge National Laboratory, Oak Ridge, TN*  
Richard Hess, *Idaho National Laboratory, Idaho Falls, ID*

**Session 4: Microbial Catalysis and Metabolic Engineering**

Chairs: Stanley Bower, *Tate & Lyle, Decatur, IL*  
Mark Eiteman, *University of Georgia, Athens, GA*

**Session 5: Bioprocessing and Separations R&D**

Chairs: Luca Zullo, *Cargill, Minneapolis, MN*  
Seth Synder, *Argonne National Laboratory, Argonne, IL*

**Session 6: Bio/Thermo-chemical Integrated Biorefinery**

Chairs: Art Ragauskas, *Georgia Institute of Technology, Atlanta, GA*  
Thomas Foust, *National Renewable Energy Laboratory, Golden, CO*

**Special Topics Session A: Life Cycle Analysis/ Sustainability**

Chairs: Bruce Dale, *Michigan State University, East Lansing, MI*  
Michael Wang, *Argonne National Laboratory, Argonne, IL*

**Special Topics Session B: International Biomass/Biofuels Update**

Chairs: Jin-Ho Seo, *Seoul University, Seoul, Korea*  
Barbel Hahn-Hagerdal, *Lund University, Lund, Sweden*

**Organizing Committee**

Jonathan Mielenz, Conference Chairman, *Oak Ridge National Laboratory, Oak Ridge, TN*  
K. Thomas Klasson, Conference Co-Chairman, *USDA Agricultural Research Service, Southern Regional Research Laboratory, New Orleans, LA*  
Jim McMillan, Conference Co-Chairman, *National Renewable Energy Laboratory, Golden, CO*  
William Adney, *National Renewable Energy Laboratory, Golden, CO*  
Doug Cameron, *Khosla Ventures, Menlo Park, CA*  
Brian Davison, *Oak Ridge National Laboratory, Oak Ridge, TN*  
Jim Duffield, *National Renewable Energy Laboratory, Golden, CO*  
Don Erbach, *USDA-Agricultural Research Service, Beltsville, MD*

Tom Jeffries, *USDA-Forest Service, Madison, WI*  
Lee Lynd, *Dartmouth College, Hanover, NH*  
Amy Miranda, *USDOE Office of the Biomass Program, Washington, DC*  
Dale Monceaux, *AdvanceBio LLC, Cincinnati, OH*  
Lisbeth Olsson, *Technical University of Denmark, Kgs Lyngby, Denmark*  
Jack Saddler, *University of British Columbia, Vancouver, British Columbia, Canada*  
Jin-Ho Seo, *Seoul National University, Seoul, Korea*  
Sharon Shoemaker, *University of California, Davis, CA*  
David Short, *E.I. DuPont de Nemours & Co., Newark, DE*  
Dave Thompson, *Idaho National Laboratory, Idaho Falls, ID*  
Jeff Tolan, *Iogen Corporation, Ontario, Canada*  
Charles Wyman, *UC Riverside, Riverside, CA*  
Gisella Zanin, *State University of Maringa, Maringa, PR, Brazil*

### Acknowledgments

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### Other Proceedings in this Series

1. "Proceedings of the First Symposium on Biotechnology in Energy Production and Conservation" (1978), *Biotechnol. Bioeng. Symp.* **8**.
2. "Proceedings of the Second Symposium on Biotechnology in Energy Production and Conservation" (1980), *Biotechnol. Bioeng. Symp.* **10**.
3. "Proceedings of the Third Symposium on Biotechnology in Energy Production and Conservation" (1981), *Biotechnol. Bioeng. Symp.* **11**.
4. "Proceedings of the Fourth Symposium on Biotechnology in Energy Production and Conservation" (1982), *Biotechnol. Bioeng. Symp.* **12**.
5. "Proceedings of the Fifth Symposium on Biotechnology for Fuels and Chemicals" (1983), *Biotechnol. Bioeng. Symp.* **13**.
6. "Proceedings of the Sixth Symposium on Biotechnology for Fuels and Chemicals" (1984), *Biotechnol. Bioeng. Symp.* **14**.
7. "Proceedings of the Seventh Symposium on Biotechnology for Fuels and Chemicals" (1985), *Biotechnol. Bioeng. Symp.* **15**.
8. "Proceedings of the Eighth Symposium on Biotechnology for Fuels and Chemicals" (1986), *Biotechnol. Bioeng. Symp.* **17**.
9. "Proceedings of the Ninth Symposium on Biotechnology for Fuels and Chemicals" (1988), *Appl. Biochem. Biotechnol.* **17,18**.
10. "Proceedings of the Tenth Symposium on Biotechnology for Fuels and Chemicals" (1989), *Appl. Biochem. Biotechnol.* **20,21**.
11. "Proceedings of the Eleventh Symposium on Biotechnology for Fuels and Chemicals" (1990), *Appl. Biochem. Biotechnol.* **24,25**.
12. "Proceedings of the Twelfth Symposium on Biotechnology for Fuels and Chemicals" (1991), *Appl. Biochem. Biotechnol.* **28,29**.
13. "Proceedings of the Thirteenth Symposium on Biotechnology for Fuels and Chemicals" (1992), *Appl. Biochem. Biotechnol.* **34,35**.
14. "Proceedings of the Fourteenth Symposium on Biotechnology for Fuels and Chemicals" (1993), *Appl. Biochem. Biotechnol.* **39,40**.
15. "Proceedings of the Fifteenth Symposium on Biotechnology for Fuels and Chemicals" (1994), *Appl. Biochem. Biotechnol.* **45,46**.
16. "Proceedings of the Sixteenth Symposium on Biotechnology for Fuels and Chemicals" (1995), *Appl. Biochem. Biotechnol.* **51,52**.
17. "Proceedings of the Seventeenth Symposium on Biotechnology for Fuels and Chemicals" (1996), *Appl. Biochem. Biotechnol.* **57,58**.
18. "Proceedings of the Eighteenth Symposium on Biotechnology for Fuels and Chemicals" (1997), *Appl. Biochem. Biotechnol.* **63–65**.
19. "Proceedings of the Nineteenth Symposium on Biotechnology for Fuels and Chemicals" (1998), *Appl. Biochem. Biotechnol.* **70–72**.
20. "Proceedings of the Twentieth Symposium on Biotechnology for Fuels and Chemicals" (1999), *Appl. Biochem. Biotechnol.* **77–79**.
21. "Proceedings of the Twenty-First Symposium on Biotechnology for Fuels and Chemicals" (2000), *Appl. Biochem. Biotechnol.* **84–86**.

22. "Proceedings of the Twenty-Second Symposium on Biotechnology for Fuels and Chemicals" (2001), *Appl. Biochem. Biotechnol.* **91–93.**
23. "Proceedings of the Twenty-Third Symposium on Biotechnology for Fuels and Chemicals" (2002), *Appl. Biochem. Biotechnol.* **98–100.**
24. "Proceedings of the Twenty-Fourth Symposium on Biotechnology for Fuels and Chemicals" (2003), *Appl. Biochem. Biotechnol.* **105–108.**
25. "Proceedings of the Twenty-Fifth Symposium on Biotechnology for Fuels and Chemicals" (2004), *Appl. Biochem. Biotechnol.* **113–116.**
26. "Proceedings of the Twenty-Sixth Symposium on Biotechnology for Fuels and Chemicals" (2005), *Appl. Biochem. Biotechnol.* **121–124.**
27. "Proceedings of the Twenty-Seventh Symposium on Biotechnology for Fuels and Chemicals" (2006), *Appl. Biochem. Biotechnol.* **129–132.**

This symposium has been held annually since 1978. We are pleased to have the proceedings of the Twenty-Seventh Symposium currently published in this special issue to continue the tradition of providing a record of the contributions made.

The Twenty-Eighth Symposium will be April 30–May 3, 2006 in Nashville, Tennessee. More information on the 27<sup>th</sup> and 28<sup>th</sup> Symposia is available at the following websites: [[http://www.eere.energy.gov/biomass/biotech\\_symposium/](http://www.eere.energy.gov/biomass/biotech_symposium/)] and [<http://www.simhq.org/html/meetings/>]. We encourage comments or discussions relevant to the format or content of the meeting.