

# Introduction to the Proceedings of the Fifteenth Symposium on Biotechnology for Fuels and Chemicals

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Biotechnology, as broadly defined in a 1991 Office of Technology Assessment report, is "any technique that uses living organisms (or parts of organisms) to make or modify products, to improve plants or animals, or to develop microorganisms for specific uses." Advances in biotechnology, coupled with environmental and political influences, continue to foster the extension of biotechnology from high-value health care applications to production of fuels and chemicals.

Biotechnology for production of fuels and chemicals includes the utilization of biomass, coal, carbon dioxide, and other resources by microorganisms and their derived enzymes to yield both primary and secondary metabolites. Several processing stages are typically considered for preparation of the raw material, its microbiological/biochemical conversion to fuels or chemicals, and recovery of products. In addition, application of biotechnology for the protection of our environment is of vital and growing importance. Ultimately, through a coordinated effort of research, development, and commercialization by teams from academia, government, and industry, biotechnology to generate fuels and chemicals useful to society will increase while reducing environmental impacts.

The Fifteenth Symposium on Biotechnology for Fuels and Chemicals continued the annual symposium series and provided a forum for the presentation of research and exchange of ideas on advances in biotechnology facilitating the production of fuels and chemicals. The technical program consisted of 33 oral and 105 poster presentations covering thermal/chemical/biological processing, applied biological and bioprocessing research, process economics and commercialization, and environmental biotechnology. Special topic discussion groups were formed on Stability of Genetically Engineered Microorganisms, Algal Biotechnology for Fuels and Chemicals, Low-Cost Materials of Construction for Biological Processes, and Novel Chemicals and Materials from Biomass. The symposium continued to provide a congenial forum for productive interaction among the attendees from the academic, industrial, and governmental sectors.

The Fifteenth Symposium was sponsored by the Office of Alternative Fuels, Office of Industrial Processes, and Office of Transportation Materials of the US

Department of Energy (DOE); the National Renewable Energy Laboratory; Oak Ridge National Laboratory; A. E. Staley Company; Archer Daniels Midland Company; BioEnergy International, L.C.; Bio-Technical Resources, Inc.; the Colorado Institute for Research in Biotechnology; Genencor International, Inc.; Grain Processing Corporation; Martin Marietta Energy Systems, Inc.; New Energy Company of Indiana; Raphael Katzen Associates International, Inc.; South Point Ethanol; Weyerhaeuser Company; Michigan Biotechnology Institute; and the Division of Biochemical Technology of the American Chemical Society.

Organization of the symposium was as follows:

#### **Organizing Committee**

Charles E. Wyman, *Chairman, National Renewable Energy Laboratory*  
Jonathan Woodward, *Cochairman, Oak Ridge National Laboratory*  
David Boron, *US Department of Energy*  
James Doncheck, *Bio-Technical Resources, Inc.*  
Elias Greenbaum, *Oak Ridge National Laboratory*  
Michael Himmel, *National Renewable Energy Laboratory*  
Tom Jefferies, *Forest Products Laboratory*  
Donald Johnson, *Grain Processing Corporation*  
Raphael Katzen, *Raphael Katzen Associates International*  
Hugh Lawford, *University of Toronto*  
Lee Lynd, *Dartmouth College*  
Richard Moorer, *US Department of Energy*

#### **Session Chairpersons and Cochairpersons**

##### ***Session 1: Thermal, Chemical, and Biological Processing***

Michael R. Ladisch, *Purdue University*  
Graham F. Andrews, *Idaho National Engineering Laboratory*

##### ***Session 2: Applied Biological Research***

John N. Saddler, *University of British Columbia*  
Shih-Perng Tsai, *Argonne National Laboratory*

##### ***Session 3: Bioprocessing Research***

Rakesh K. Bajpai, *University of Missouri, Columbia*  
Barbara J. Goodman, *National Renewable Energy Laboratory*

##### ***Session 4: Process Economics and Commercialization***

Donald L. Johnson, *Grain Processing Corporation*  
Lawrence J. Russo, *New Energy Company of Indiana*

##### ***Session 5: Environmental Biotechnology***

Jonathan R. Mielenz, *COGNIS, Inc.*  
Mark Reeves, *Oak Ridge National Laboratory*

##### ***Poster Session***

Antonios Antonopoulos  
Karel Grohmann

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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.

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

The Sixteenth Symposium is planned for May 9–13, 1994 in Gatlinburg, Tennessee. We encourage comments or discussions relevant to the format or content of that meeting.