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# Genetic Engineering for Nitrogen Fixation

**Edited by Alexander Hollaender,**

R. H. Burris, P. R. Day, R. W. F. Hardy, D. R. Helinski,  
M. R. Lamborg, L. Owens, and R. C. Valentine

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*Associated Universities, Inc.  
Washington, D. C.*

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# **Genetic Engineering for Nitrogen Fixation**

## **BASIC LIFE SCIENCES**

**Alexander Hollaender, General Editor**

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Washington, D.C.

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R. W. F. Hardy, D. R. Helinski, M. R. Lamborg, L. Owens,  
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of the Brookhaven National Laboratory and his staff,  
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of the proceedings and the copy editing.

## FOREWORD

There is a time in scientific research when a number of developments coincide making it possible to progress with a tough and complicated problem. It is believed that such a time has come in the area of biological nitrogen fixation. A better understanding of photosynthesis, cell hybridization, plasmid, and gene transfer between cells not necessarily genetically related, have opened new avenues of research. New developments in traditional genetics, cell biology, biochemistry, including enzyme chemistry, and plant physiology have brought about the feeling this is a most appropriate time to pull together the different approaches in a conference where the lines of research could be discussed and thus help to speed up developments in this area.

What makes biological nitrogen fixation especially important is the promise that a good understanding of the basic problem would help us to make organisms more amenable to fix nitrogen, not only in symbiosis with legumes, but also with other plant species and develop a wider variety of organisms with the ability to fix  $N_2$ . It will also encourage a search for naturally occurring  $N_2$  fixing organisms other than the traditional  $N_2$  fixers. Some success has already been encountered in this area.

Success in broadening the field of nitrogen fixing would help to increase food supply, especially in developing countries which cannot afford to purchase synthetic nitrogen sources.

It was also thought important to have the public involved in this discussion. A special effort was made to involve the press as the window to the public. Some of the negative aspects of increased biological nitrogen fixation and its international implications were brought up. Addi-

tional public aspects of the  $N_2$  problem fixation will be discussed at a public meeting planned at the National Academy of Sciences Auditorium in Washington, D.C. the evening of October 5 and all day on October 6, 1977.

*Alexander Hollaender*



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## OPENING REMARKS

Alexander Hollaender

Associated Universities, Inc.

Washington, D. C. 20036

I am pleased to welcome you on behalf of Associated Universities, Inc. AUI, now in its thirty-first year, was organized to establish and operate the Brookhaven National Laboratory under contract to the Atomic Energy Commission. The formation of AUI and BNL provided a new approach to the support of research by the Government, especially for large-scale scientific enterprises of interest to the academic community. In 1956 AUI also established, and has since operated, the National Radio Astronomy Observatory under contract to the National Science Foundation. The policies for and practices of both institutions have been conducive to productive research undertakings, utilizing effectively the country's scientific and engineering talents, especially those from the academic community. In addition, AUI has occasionally undertaken short-term studies for the Government.

My involvement in this Conference has a long background. My interest in radiation biology led me into genetics with special emphasis on mutagenesis (including carcino- and teratogenesis), later to the profound genetic effects of environmental chemicals. It may look like there is a big jump from this to nitrogen fixation. Actually it is not, as the title of this Conference indicates.

The history of nitrogen fixation leads back to the early part of this century. Having spent ten years on the campus of the University of Wisconsin at Madison, one could not avoid being impressed by the efforts at Madison at least fifty years ago to untangle the mystery of  $N_2$  fixation.

It is the development of the new tools of genetics. Artificially induced genetic changes produced by the many mutagenic agents, the transplantation of chromosomes, part of chromosomes and genes, cell hybridization, and all the other new approaches discussed at this meeting, have made it logical to develop this Conference at this time.

I had the privilege to read many reports and other publications on work supported with funds from the National Science Foundation and other Government Agencies on a variety of projects in this and related fields in the last three years. This opportunity convinced me that this is the logical time to develop this conference, when the new developments in genetic engineering are just reaching a stage where laboratory findings and practical applications could be encouraged through an open discussion.

My conversations with Oscar Zaborsky and others at NSF encouraged me to apply for funds for this Conference. The program was developed by our Advisory Committee.

A few words about the program--we felt it would be helpful if besides the invited papers we had a number of round tables:

- |                         |  |
|-------------------------|--|
| On Tuesday afternoon:   | Potential associated nitrogen fixation systems.  |
| On Tuesday night:       | Recombinant DNA guidelines for nitrogen fixation in plant sciences.  |
| On Wednesday afternoon: | Contributed short paper on new developments of importance to nitrogen fixation.                              |
| On Wednesday night:     | Round table with the press and questions from the public.  |
| On Thursday morning:    | A discussion of what possibly could go wrong in this area, especially in regard to its environmental impact. |
|                         | What are the legal and patent aspects?   |

And finally, what would be the international implications?

A few words about the conduct of this meeting. All discussions will be taken down and each speaker will have a chance to review the remarks he or she made. Please carefully read, correct and return the transcript of your remarks when they are handed to you the following morning. We are counting on your cooperation. We hope to get the copy ready for the publisher by April 1st. We have the assurance of Plenum Press that the book will be available 100 days after they receive the copy-ready manuscripts.

I should apologize for the long delay in getting all of the information to you. We would not have been able to accomplish all this in fourteen days without the cooperation of Elliott Shaw, Chairman of the Biology Department, and Virginia Sayre who is in charge of administration. A good part of the blame for the delay should be mine, since I underestimated the bureaucratic steps necessary for approval of this project.

I now have the pleasure to introduce Dr. Oskar Zaborsky of NSF-RANN who did so much to encourage me to proceed with the planning of this Conference.



