Front Matter
April Program Abstracts

113th Annual Meeting
The Ohio Academy of Science
Meeting jointly with the
Ohio Branch of
The American Society for Microbiology

Hosted by
The Youngstown State University
Youngstown, Ohio
April 16-17, 2004
The Ohio Journal of Science  
ISSN 0030-0950

Editorial Policy:

General:
THE OHIO JOURNAL OF SCIENCE considers original contributions from members and non-members of the Academy in all fields of science. While special consideration will be given to manuscripts concerned with Ohio subject matter, other reports with scientific merit will be reviewed for publication. Submission of a manuscript is understood to mean that the work is original and unpublished, and is not being considered for publication elsewhere. All manuscripts considered for publication will be peer-reviewed. The opinions expressed by reviewers are their own, and do not represent the views of the Ohio Academy of Science or THE OHIO JOURNAL OF SCIENCE. Manuscripts and illustrations should be prepared in triplicate in accordance with current guidelines published in THE JOURNAL at least once a year, and submitted to:

Dr. Isadore Newman, Editor  
THE OHIO JOURNAL OF SCIENCE  
Idabelle Firestone Center  
41 Arch Street  
Akron, OH  44304-1499  USA

Page Charges:
Publication of THE OHIO JOURNAL OF SCIENCE requires that authors assist in meeting publication expenses. These costs will be assessed at $85 per page for members of the Academy and $120 per page for non-members. In multi-authored papers, each author must be a member of the Academy at the time of publication to be eligible for the reduced member rate. Papers which exceed 12 printed pages may be charged full production costs. A bill for page charges will be sent to the communicating author by the Ohio Academy of Science at the time of publication.

Failure to Receive THE JOURNAL:
Any claim of failure to receive subscription issues of THE JOURNAL must be submitted to the Ohio Academy of Science within six months of date of issue of the missing number, to be recognized.

Listing Services:
THE OHIO JOURNAL OF SCIENCE is listed or abstracted in several sources including:

- AcadSci Abstracts
- Bibliography of Agriculture
- Biological Abstracts
- Chemical Abstracts
- Current Advances in Ecological Sciences
- Current Contents (Agriculture, Biology & Environmental Sciences)
- Deep Sea Research and Oceanography Abstracts
- Environment Abstracts
- Environmental Information Center
- Forest Products Abstracts
- Forestry Abstracts
- Geo Abstracts
- GEOBASE
- Geology Abstracts
- GeoRef
- Helminthological Abstracts
- Horticulture Abstracts
- Nuclear Science Abstracts
- Review of Plant Pathology
- Selected Water Resources Abstracts
- World Agricultural Economics and Rural Sociology Abstracts

Date of issue — March 2004
Copyright © 2004 by The Ohio Academy of Science
Printing — CPMM Services Group, Inc., Columbus, OH USA

Division Editorial Board  
The Ohio Journal of Science

Biological Sciences
Dr. Chester Ray Cooper, Youngstown State University  
Dr. Daniel Ely, The University of Akron  
Dr. Robert F. Rakowski, Ohio University

Chemical Sciences
Dr. George R. Newkome, The University of Akron

Earth and Space Sciences
Dr. Yildirim Dilek, Miami University of Ohio  
Dr. Gregory Schumacher, Ohio Department of Natural Resources

Education
Dr. Charles L. Salzberg, Utah State University  
Dr. Beth Stroble, The University of Akron

Information Technology, Computing and Communications
Al Herbert, The University of Akron

Mathematical Sciences
Dr. Arjun Gupta, Bowling Green State University

Medical Sciences and Health Technology
Mitchell Harmon, M.D., Ph.D., Kronos Longevity Institute, Phoenix, AZ  
Richard Josephson, M.S., M.D., Summa Health Systems, Akron, OH

Methodology
Dr. Keith McNeil, New Mexico State University  
Dr. John Pohlman, Southern Illinois University

Nanotechnology
Dr. Lloyd Goettler, The University of Akron

Physical Sciences and Polymer Sciences
Dr. Ernst Von Meerwall, The University of Akron

Social and Behavioral Sciences
Dr. Dick Genardi, The Union Institute  
Dr. Andrea Karkowski, Capital University

Division Editors are needed in the following areas:

Biotechnology

Ecological and Environmental Sciences and Resource Management

Engineering and Technology

Molecular Genetics, Genomics, and Cell Biology

Send a letter of interest outlining publication experience and a full curriculum vitae to the Editor at the address above.
# Contents

113th Annual Meeting  
**The Ohio Academy of Science**  
Meeting jointly with the  
**Ohio Branch of the American Society for Microbiology (**OBASM)**

Hosted by  
**The Youngstown State University**  
**Youngstown, Ohio**  
**April 16-17, 2004**

**Theme:** *Intellectual Property: Essential Capital for the New Economy*

| Registration | 2 |
| Registration Form | 47 |
| Campus Map | 43 |
| Parking | 2 |
| Meals | 2 |
| General Schedule | 2-3 |
| Friday Reception and President’s Address | 2 |
| All-Academy Lecture | 2 |
| Official Notice of Business Meeting | 2, 42 |
| About Our Host | 3 |
| Housing | 4 |
| *OBASM Schedule | 5 |
| Peer-Reviewed Abstracts & Undergraduate Research Summaries | 5 |
| Posters | 6 |
| Podium Sessions | 25 |
| Indices | 5 |
| Session Abstracts | 46 |

---

Cover photograph: Jones Hall  
Youngstown State University