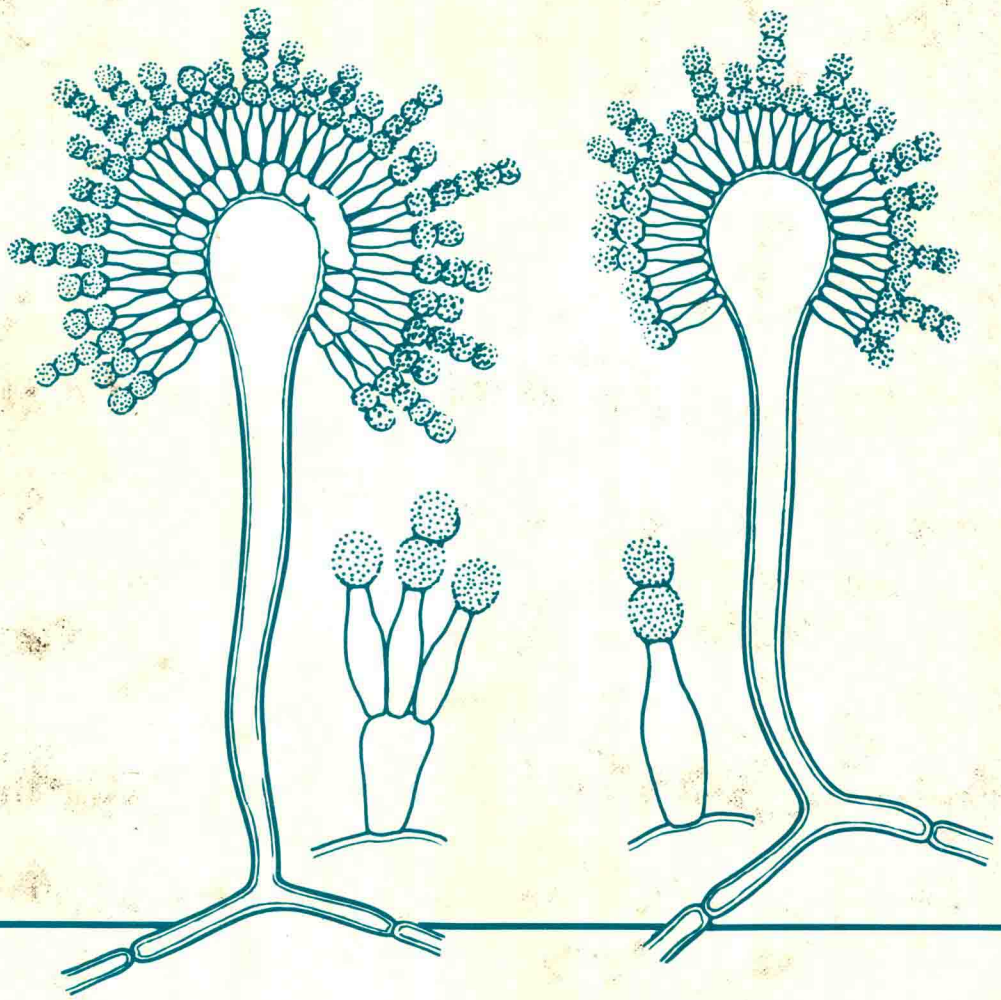
BIODETERIORATION RESEARCH 1



Edited by
Gerald C. Llewellyn
and
Charles E. O'Rear

BIODETERIORATION RESEARCH 1

Edited by

Gerald C. Llewellyn

Virginia Department of Health
Richmond, Virginia

and

Charles E. O'Rear

George Washington University
Washington, D.C.

PLENUM PRESS • NEW YORK AND LONDON

Library of Congress Cataloging in Publication Data

Pan American Biodeterioration Society. Meeting (1st: 1986: Washington, D.C.)
Biodeterioration research 1.

"Proceedings of the First Annual Meeting of the Pan American Biodeterioration Society, held July 17-19, 1986, in Washington, D.C."—T.p. verso.
Includes bibliographies and indexes.
1. Materials—Biodeterioration—Congresses. 2. Materials—Microbiology—Congresses. 3. Mycotoxins—Congresses. I. Llewellyn, Gerald C. II. O'Rear, Charles E. III. Title. [DNLM: 1. Biodegradation—congresses. W3 PA187 1st 1986b / WA 671 P187 1986b]
TA418.74.P36 1986 620.1'1223 87-25494
ISBN 0-306-42764-8

Proceedings of the First Annual Meeting of the Pan American Biodeterioration Society, held July 17-19, 1986, in Washington, D.C.

PROGRAM AND PLANNING COMMITTEE

CHARLES E. O'REAR
Professor & Chairman
Department of Forensic Sciences
The George Washington University
Washington, D.C. 20052, U.S.A.

ALAN W. POSTLETHWAITE
Deputy Director of Conservation Analytical Laboratory
The Smithsonian Institution
Washington, D.C. 20560, U.S.A.

GERALD C. LLEWELLYN
Director, Bureau of Toxic Substances Information
Virginia Department of Health
Richmond, VA 23219, U.S.A.

RICHARD A. SMUCKER
Chesapeake Biological Laboratories
University of Maryland
Solomons, MD 20688, U.S.A.

SESSION ORGANIZERS (O), SESSION CHAIRPERSONS (C), AND CO-CHAIRPERSONS (CC)

Roy E. Bry (CC)
United States Department of Agriculture/Agricultural Research Service
Alan W. Postlethwaite (O,C)
The Smithsonian Institution
Gerald C. Llewellyn (O,C)
Virginia Department of Health
John D. Reynolds (CC)
Virginia Commonwealth University
Richard A. Smucker (O,C)
University of Maryland
George A. Bean (CC)
University of Maryland
Harold W. Rossmoore (C)
Wayne State University
Winston M. Hagler (CC)
North Carolina State University
Rufus Guthrie (C)
University of Texas at Houston
John D. Bultman (CC)
U.S. Naval Research Laboratory
Marion E. Simpson (CC)
United States Department of Agriculture
William R. Chamberlain (CC)
Virginia State Library
William V. Dashek (C)
Atlanta University
Charles E. O'Rear (O,C,CC)
The George Washington University

PREFACE

The present volume contains the majority of the papers presented at the First Pan-American Biodeterioration Society Annual Meeting held at The George Washington University, Washington, D.C., USA, on July 17, 18, and 19, 1986. The organization and resultant program were born of ideas primarily conceived by H.O.W. Eggins from Bioquest, UK and C.E. O'Rear, USA. The sponsors for the first meeting included The George Washington University, The Smithsonian Institution and The Virginia Department of Health. The program was organized by members of the Program and Planning Committee. They invited leading scientists in specific topic areas and accepted contributed papers from individuals and laboratories actively involved in relevant areas of research and study. The Society (PABS) thus ensured that the program reflected current developments, informed reviews, embroynic and developing areas, and critical assessment for several aspects of the present state of knowledge as it relates to the five major sections of the proceedings.

All the papers and presentations under went both scientific and technical review. A few papers do not appear in the volume because they were judged not suitable for publication. The order and organization of the contributions vary somewhat from that of the actual meeting session.

This book is the results of the efforts of the Program and Planning Committee, section organizers, PABS co-program chairmen, session chairpersons, session co-chairpersons, authors, and those behind the scene assistants listed in Acknowledgments and Appreciations. This publication is considered to be a general contribution to the broad science of biodeterioration. Also, with many of the papers associated with mycotoxins, the newly born PABS completed the cycle some 20 years later since this topic was predominant at the earlier and newly developing parent, The International Biodeterioration Society in the United Kingdom.

The international aspect of this book and meeting is supported by authors and/or participants representing six nations. Participants

primarily represented North America and South America, therefore quite appropriately complementing PABS, the Pan-American name sake.

We believe these reviewed and edited proceedings will be of value to a broad range of scientists.

The Editors

ACKNOWLEDGMENTS AND APPRECIATIONS

KIMBERLY COOPER

JEANNETTE JONES

GLADYS LLEWELLYN

STANELY ORCHEL, JR.

BILLY RUTHERFORD

BARBARA SPAIN

VICKIE O'DELL

JOHN D. REYNOLDS

CINDY GOSS

WILLIAM V. DASHEK

PETER C. SHERERTZ

ROBERT STARNER

CONTENTS

SECTION II

Mycotoxins As Biodeteriogens and Mycotoxin Biodegradation

SECTION III

General Biodeterioration and Biodegradation

SECTION IV

Biodeterioration Research For the Conservation of Art and Antiquity in Libraries, Museums, and the Outdoors

SECTION V

Chitin and Lignocellulose Biodeterioration and Biodegradation

INTRODUCTION AND OVERVIEW

The Impact Of Biodeteriogens On Human Health, Economics, Quality Of Life, And The Arts

Change, albeit slow paced and almost invisible at times and drastically evident at other times, appears to be a fundamental concept associated with the biotic and abiotic components of the earth. Extra terrestrial data seems to complement this observation also. One could discuss entropy, equilibrium, and enthalpy but our interest centers primarily about breakdown or alteration of matter, in particular bio-breakdown. Biodeterioration would be by our definition, the undesirable change, usually caused by microorganisms but not exclusively so. Although fungi and bacteria are often the prime actors in biodeterioration, other organisms such as plants, invertebrates, insects, birds, rodents, and at times even the chemicals in air or water are often included as part of this broad, multi-disciplinary topic. Biodegradation, not to be excluded, but often separated by the "purist" concerns, in my belief, a planned and purposeful breakdown or alteration due to organisms and at times even by chemicals.

Biodeterioration and biodegradation influence most aspects of our lives. This begins with the effects relevant to public health issues, such as the changes in water, food, feed, and our direct environment. Health hazard control is very important. Toxic substances, hazardous waste, and infectious agents support this importance. It, biodeterioration, continues and includes a linkage to economics as well as with the survival and quality of our material objects. This varies from clothing to buildings, to transportation modes including structures, and fuels, to medicinals, and pharmaceuticals, and to xenobiotics.

Often lost in the important aspects of health and economics is the deterioration of objects of art, problems seen in our archives, and damage in museums. The undesirable biodeterioration of such irreplaceable

materials and treasurers is of the ultimate importance. The preservation of statues and archeological objects is needed.

It is evident that biodeterioration topics include corrosion, insects and pesticides, agricultural storage of crops, water quality, forensic science evidence, cell wall breakdown ..... there are even some colleagues who include the effects on organisms, their resultant chemicals, xenobiotics, ... on the human as a biodeterioration process and in the case of chemical biological warfare agents (the nerve gases and the alleged use of T-2 mycotoxin) as biodegradation.

The major biodeteriogens discussed in the proceedings include: Toxigenic occurrence of fungal metabolites in food and feeds as well as efforts to control toxin production and detoxifying the biodeteriogens, i.e., mycotoxins. Deterioration of man-made and synthetic fibers including cotton, wood, forensic science evidence, and the relevant health-related aspects. Controlling biodeterioration in museum materials and objects of art is included also. The General Biodeterioration Section includes biodeteriogens influencing hydraulic fluids, corrosion .....

The above four major section topics plus general biodeterioration serve as the organizational basis for the scientific reports to follow. Although few if any scientists would consider him/herself to be a biodeteriologist, the nurturing of this post-embryonic field, biodeteriology, with all its multi-disciplinary overtones, does have substantial developments to share and exchange. It is essential that they be communicated from this point of view so that those involved in the aspects of these sub-areas can mutually benefit. Therefore, herein are presented recent data reports and some review summaries by biodeteriologists, as they relate to economics, conservation and preservation, and public health concerns.

Gerald C. Llewellyn, Ph.D.
Virginia Department of Health
Bureau of Toxic Substances

SECTION I

BIODETERIORATION AND BIODEGRADATION OF SYNTHETIC MATERIALS AND STRUCTURES OF BIOLOGICAL ORIGIN