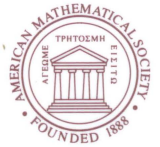
CONTEMPORARY MATHEMATICS

39

Errett Bishop: Reflections on Him and His Research

Proceedings of the Memorial Meeting
for Errett Bishop
September 24, 1983
University of California, San Diego

Murray Rosenblatt
Editor



American Mathematical Society

http://dx.doi.org/10.1090/conm/039

Recent Titles in This Series

164 **Cameron Gordon, Yoav Moriah, and Bronislaw Wajnryb, Editors,** Geometric topology, 1994

163 **Zhong-Ci Shi and Chung-Chun Yang, Editors,** Computational mathematics in China, 1994

162 **Ciro Ciliberto, E. Laura Livorni, and Andrew J. Sommese, Editors,** Classification of algebraic varieties, 1994

161 **Paul A. Schweitzer, S. J., Steven Hurder, Nathan Moreira dos Santos, and José Luis Arraut, Editors,** Differential topology, foliations, and group actions, 1994

160 **Niky Kamran and Peter J. Olver, Editors,** Lie algebras, cohomology, and new applications to quantum mechanics, 1994

159 **William J. Heinzer, Craig L. Huneke, and Judith D. Sally, Editors,** Commutative algebra: Syzygies, multiplicities, and birational algebra, 1994

158 **Eric M. Friedlander and Mark E. Mahowald, Editors,** Topology and representation theory, 1994

157 **Alfio Quarteroni, Jacques Periaux, Yuri A. Kuznetsov, and Olof B. Widlund, Editors,** Domain decomposition methods in science and engineering, 1994

156 **Steven R. Givant,** The structure of relation algebras generated by relativizations, 1994

155 **William B. Jacob, Tsit-Yuen Lam, and Robert O. Robson, Editors,** Recent advances in real algebraic geometry and quadratic forms, 1994

154 **Michael Eastwood, Joseph Wolf, and Roger Zierau, Editors,** The Penrose transform and analytic cohomology in representation theory, 1993

153 **Richard S. Elman, Murray M. Schacher, and V. S. Varadarajan, Editors,** Linear algebraic groups and their representations, 1993

152 **Christopher K. McCord, Editor,** Nielsen theory and dynamical systems, 1993

151 **Matatyahu Rubin,** The reconstruction of trees from their automorphism groups, 1993

150 **Carl-Friedrich Bödigheimer and Richard M. Hain, Editors,** Mapping class groups and moduli spaces of Riemann surfaces, 1993

149 **Harry Cohn, Editor,** Doeblin and modern probability, 1993

148 **Jeffrey Fox and Peter Haskell, Editors,** Index theory and operator algebras, 1993

147 **Neil Robertson and Paul Seymour, Editors,** Graph structure theory, 1993

146 **Martin C. Tangora, Editor,** Algebraic topology, 1993

145 **Jeffrey Adams, Rebecca Herb, Stephen Kudla, Jian-Shu Li, Ron Lipsman, and Jonathan Rosenberg, Editors,** Representation theory of groups and algebras, 1993

144 **Bor-Luh Lin and William B. Johnson, Editors,** Banach spaces, 1993

143 **Marvin Knopp and Mark Sheingorn, Editors,** A tribute to Emil Grosswald: Number theory and related analysis, 1993

142 **Chung-Chun Yang and Sheng Gong, Editors,** Several complex variables in China, 1993

141 **A. Y. Cheer and C. P. van Dam, Editors,** Fluid dynamics in biology, 1993

140 **Eric L. Grinberg, Editor,** Geometric analysis, 1992

139 **Vinay Deodhar, Editor,** Kazhdan-Lusztig theory and related topics, 1992

138 **Donald St. P. Richards, Editor,** Hypergeometric functions on domains of positivity, Jack polynomials, and applications, 1992

137 **Alexander Nagel and Edgar Lee Stout, Editors,** The Madison symposium on complex analysis, 1992

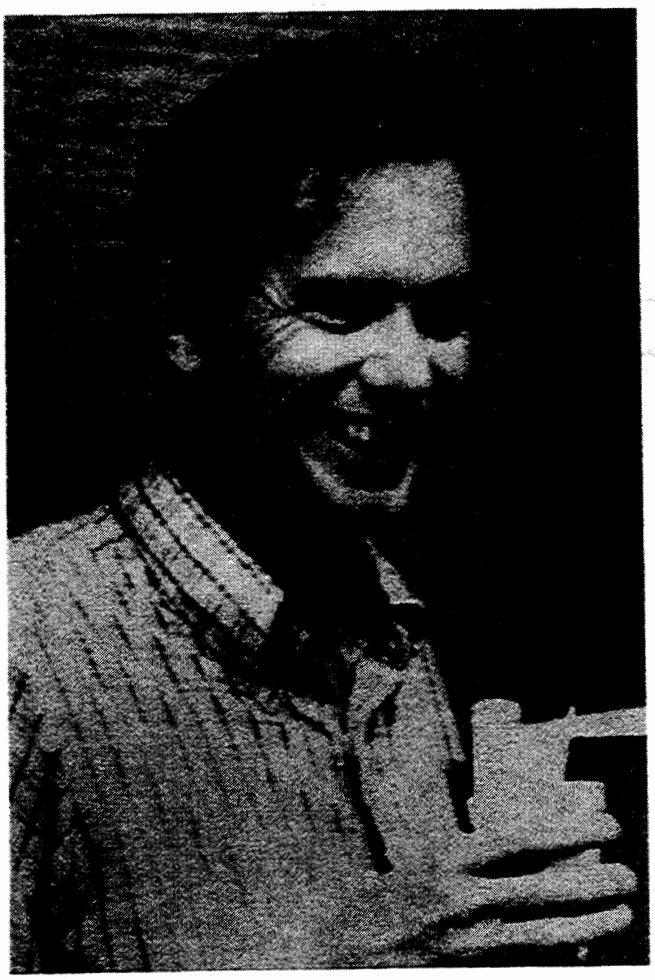
136 **Ron Donagi, Editor,** Curves, Jacobians, and Abelian varieties, 1992

135 **Peter Walters, Editor,** Symbolic dynamics and its applications, 1992

134 **Murray Gerstenhaber and Jim Stasheff, Editors,** Deformation theory and quantum groups with applications to mathematical physics, 1992

(*Continued in the back of this publication*)

Errett Bishop: Reflections on Him and His Research



Errett Bishop

CONTEMPORARY MATHEMATICS

39

Errett Bishop: Reflections on Him and His Research

Proceedings of the Memorial Meeting
for Errett Bishop
September 24, 1983
University of California, San Diego

Murray Rosenblatt
Editor

American Mathematical Society
Providence, Rhode Island

EDITORIAL BOARD

R. O. Wells, Jr., managing editor
Adriano M. Garsia
James I. Lepowsky
Jan Mycielski
Johannes C. C. Nitsche
Irving Reiner
Alan D. Weinstein

PROCEEDINGS OF THE MEMORIAL MEETING FOR ERRETT BISHOP

HELD AT THE UNIVERSITY OF CALIFORNIA, SAN DIEGO

SEPTEMBER 24, 1983

These proceedings were prepared by the American Mathematical Society with partial support from the National Science Foundation Grant DMS 83-12106.

1991 *Mathematics Subject Classification.* Primary 03F65; Secondary 03A05, 03E25, 03E45, 36A03, 46J10, 46J20, 46J15, 32E10, 32C10.

Library of Congress Cataloging-in-Publication Data

Main entry under title:
Errett Bishop: reflections on him and his research.
Bibliography: p.
Contents: Vita of Errett Bishop–Publications of Errett Bishop–Schizophrenia in contemporary mathematics/Errett Bishop–[etc.]
1. Function algebras—Addresses, essays, lectures. 2. Mathematics—Philosophy—Addresses, essays, lectures. 3. Bishop, Errett, d. 1983—Addresses, essays, lectures. I. Rosenblatt, Murray. II. Bishop, Errett, d. 1983.
QA326,E75 1984 510 85-752
ISBN 0-8218-5040-7

Copying and reprinting. Individual readers of this publication, and nonprofit libraries acting for them, are permitted to make fair use of the material, such as to copy an article for use in teaching or research. Permission is granted to quote brief passages from this publication in reviews, provided the customary acknowledgment of the source is given.

Republication, systematic copying, or multiple reproduction of any material in this publication (including abstracts) is permitted only under license from the American Mathematical Society. Requests for such permission should be addressed to the Manager of Editorial Services, American Mathematical Society, P.O. Box 6248, Providence, Rhode Island 02940-6248. Requests can also be made by e-mail to `reprint-permission@math.ams.org`.

The owner consents to copying beyond that permitted by Sections 107 or 108 of the U.S. Copyright Law, provided that a fee of $1.00 plus $.25 per page for each copy be paid directly to the Copyright Clearance Center, Inc., 222 Rosewood Drive, Danvers, Massachusetts 01923. When paying this fee please use the code 0271-4132/94 to refer to this publication. This consent does not extend to other kinds of copying, such as copying for general distribution, for advertising or promotional purposes, for creating new collective works, or for resale.

© Copyright 1985 by the American Mathematical Society. All rights reserved.
The American Mathematical Society retains all rights except those granted to the United States Government.
Printed in the United States of America.
♾ The paper used in this book is acid-free and falls within the guidelines established to ensure permanence and durability.
♻ Printed on recycled paper.

All articles in this volume were printed from copy prepared by the authors.

10 9 8 7 6 5 4 3 2 99 98 97 96 95 94

CONTENTS

Preface ix

Association of Authors xi

Vita of Errett Bishop xiii

Publications of Errett Bishop xv

Schizophrenia in Contemporary Mathematics
Errett Bishop 1

Errett Bishop - In Memoriam
Stefan Warschawski 33

The Work of Errett Bishop in Several Complex Variables
John Wermer 41

Recollections
John Kelley 51

Aspects of Constructive Analysis
Halsey Royden 57

The Work of Errett Bishop and Uniform Algebras
Irving Glicksberg 65

Remembrances of Errett Bishop
Anil Nerode, George Metakides and Robert Constable 79

On Bishop's Hahn-Banach Theorem
G. Metakides, A. Nerode and R. A. Shore 85

PREFACE

Errett Bishop was distinguished for his mathematical work on function algebras and the foundations of mathematics. His research on function algebras and complex analysis was universally recognized. The research on foundations which came later was also remarkable. As is well known, many people have very strong opinions concerning foundations. The object here is to present a view of Errett Bishop as an individual, a colleague to many of us, and as a mathematician. A vita of Bishop is first given with a listing of his mathematical papers. This is followed by a paper of Bishop's titled "Schizophrenia in contemporary mathematics." This paper was distributed in conjunction with the Colloquium Lectures he delivered in 1973 at the Seventy-Eighth Meeting of the American Mathematical Society.

Bishop died April 14, 1983 at his home in La Jolla after a brief illness. The Mathematics Department of the University of California, San Diego, organized a meeting September 24, 1983 in his memory at which a number of his former colleagues were invited to speak about him and his work. They were Stefan Warschawski of UCSD, John Wermer of Brown University, John Kelley of UC Berkeley, Irving Glicksberg of the University of Washington, and Gabriel Stolzenberg of Northeastern University. Unfortunately Stolzenberg withdrew his paper on Errett Bishop. Other than that the papers are printed in full after Errett Bishop's paper. At the memorial meeting a scholarship in mathematics in Errett Bishop's name was established at UCSD, funded by a gift of his mother Mrs. Helen Bishop. To our sorrow, Irving Glicksberg died shortly after his manuscript of his paper was completed. Thanks are due to the Mathematics Department and the administration of UCSD for help in organizing the memorial meeting. A last paper on Bishop's work written by Metakides, Nerode and Shore concludes this selection of papers. This is preceded by a short paper of Nerode, Metakides and Constable on remembrances of Errett Bishop. Errett Bishop is survived by his wife Jane, his two sons, Edward and Thomas, and his daughter Rosemary.

La Jolla, California, 1984 Murray Rosenblatt

Some participants in the memorial meeting for Bishop. From left to right: I. Glicksberg, J. Wermer, S. Warschawski, H. Royden, J. Kelly, and M. Rosenblatt.

ASSOCIATION OF AUTHORS

Errett Bishop	Mathematics Department University of California, San Diego
Robert Constable	Computer Science Department Cornell University
Irving Glicksberg	Mathematics Department University of Washington, Seattle
John Kelley	Mathematics Department University of California, Berkeley
George Metakides	University of Patras
Anil Nerode	Mathematics Department Cornell University
Halsey Royden	Mathematics Department Stanford University
Richard Shore	Mathematics Department Cornell University
Stefan Warschawski	Mathematics Department University of California, San Diego
John Wermer	Mathematics Department Brown University

VITA

Errett Bishop was born July 14, 1928. He received a Bachelor of Science degree in 1947, a Master of Science in 1949, and a Ph. D. in 1955 all from the University of Chicago. From 1950 to 1952 he was in the U.S. Army stationed at the Bureau of Standards in Washington, D.C. carrying out mathematical research in ordnance. His academic positions are listed:

Instructor of Mathematics 1954-1957

Assistant Professor of Mathematics 1957-1959

Associate Professor of Mathematics 1959-1962

Professor of Mathematics 1962-1965

all at the University of California, Berkeley.

Professor of Mathematics 1965-1983

University of California, San Diego.

Bishop held a Sloan Foundation Fellowship from 1958 to 1961. In 1961-1962 he was a member of the Institute for Advanced Study at Princeton. He was a Miller Fellow during the year 1964-1965. Bishop gave a number of distinguished invited lectures, among them an invited talk to the International Congress of Mathematicians at Moscow, USSR (1966), the Hedrick lectures of the Mathematical Association of America (1969), and the Colloquium Lectures of the American Mathematical Society (1973). He was elected a fellow of the American Academy of Arts and Sciences. His doctoral students at UCSD were James D. Brom (1974), Yuen-Kwok Chan (1969), Henry Cheng (1971), Merrill B. Goldberg (1969), John A. Nuber (1969) and Jonathan B. Tennenbaum (1973).

PUBLICATIONS OF ERRETT BISHOP

1. "Spectral theory for operators on a Banach space," Trans. Amer. Math. Soc., 86, No. 2 (November 1957), 414-445.

2. "Subalgebras of functions on a Riemann surface," Pacific J. Math., 8, No. 1 (1958).

3. "Measures orthogonal to polynomials," Proc. Nat'l. Acad. Sci., 44, No. 3 (March 1958), 278-280.

4. "The structure of certain measures," Duke Math. J., 25, No. 2 (June 1958), 283-290.

5. "Approximation by a polynomial and its derivatives on certain closed sets," Proc. Amer. Math. Soc., 9, No. 6 (December 1958), 946-953.

6. "A duality theorem for an arbitrary operator," Pacific J. Math., 9, No. 2 (1959).

7. "A minimal boundary for function algebras," Pacific J. Math., 9, No. 3 (1959).

8. "Some theorems concerning function algebras," Bull. Amer. Math. Soc., 65, No. 2 (March 1959), 77-78.

9. (with Karel de Leeuw) "The representations of linear functionals by measures on sets of extreme points," Annales de L'Institut Fourier, 9 (1959).

10. "Simultaneous approximation by a polynomial and its derivatives," Proc. Amer. Math. Soc., 10, No. 5 (October 1959), 741-743.

11. "Boundary measures of analytic differentials," Duke Math. J., 27, No. 3 (September 1960), 331-340.

12. "A generalization of the Stone-Weierstrass Theorem," Pacific J. Math., 11, No. 3 (1961).

13. (with R. R. Phelps) "A proof that every Banach space is subreflexive," Bull. Amer. Math. Soc., 67, No. 1 (January 1961), 97-98.

14. "Mappings of partially analytic spaces," Amer. J. Math., 83, No. 2 (April 1961), 209-242.

15. "Some global problems in the theory of functions of several complex variables," Amer. J. Math., 83, No. 3 (July 1961), 479-498.

16. "Partially analytic spaces," Amer. J. Math., 83, No. 4 (October 1961), 669-692.

17. "A general Rudin-Carleson Theorem," Proc. Amer. Math. Soc., 13, No. 1 (February 1962), 140-143.

18. "Analytic functions with values in a Frechet space," Pacific J. Math., 12, No. 4 (1962).

19. "Analyticity in certain Banach algebras," Trans. Amer. Math. Soc., 102, No. 3 (March 1962), 507-544.

20. (with R. R. Phelps) "The support functionals of a convex set," Proc. Symposia in Pure Math., VII (1963).

21. "Holomorphic completions, analytic continuations and the interpolation of semi-norms," Annals of Math., 78, No. 3 (November 1963), 468-500.

22. "Representing measures for points in a uniform algebra," Bull. Amer. Math. Soc., 70, No. 1 (January 1964), 121-122.

23. "Conditions for the analyticity of certain sets," Mich. Math. J., 11 (1964), 289-304.

24. "Uniform algebras," Proc. Conf. on Complex Analysis, Minneapolis (1964).

25. "Differentiable manifolds in complex Euclidean space," Duke Math. J., 32, No. 1 (March 1965), 1-22.

26. Constructive Methods in the Theory of Banach Algebras, in Function Algebras, 1966.

27. "An upcrossing inequality with applications," Mich. Math. J., 13 (1966), 1-13.

28. Foundations of Constructive Analysis, McGraw-Hill Book Company, 1967.

29. "A constructivization of abstract mathematical analysis," Proc. Inter. Congress Math., Moscow, 1966.

30. "Mathematics as a numerical language, intuitionism and proof theory," in Proc. Conf. Buffalo, New York, 1968, pp. 53-71. North Holland, Amsterdam, 1970.

31. (with Henry Cheng) "Constructive Measure Theory," to appear in Memoirs, Amer. Math. Soc.

32. "The crisis in contemporary mathematics," Historia Mathematica, 2 (1975), 507-517.

33. Review of "Elementary Calculus," by H. Jerome Keisler, to appear in Amer. Math. Monthly.

34. Schizophrenia in contemporary mathematics, lecture.

Recent Titles in This Series

(*Continued from the front of this publication*)

133 **Alan Adolphson, Steven Sperber, and Marvin Tretkoff, Editors,** p-Adic methods in number theory and algebraic geometry, 1992

132 **Mark Gotay, Jerrold Marsden, and Vincent Moncrief, Editors,** Mathematical aspects of classical field theory, 1992

131 **L. A. Bokut', Yu. L. Ershov, and A. I. Kostrikin, Editors,** Proceedings of the International Conference on Algebra Dedicated to the Memory of A. I. Mal'cev, Parts 1, 2, and 3, 1992

130 **L. Fuchs, K. R. Goodearl, J. T. Stafford, and C. Vinsonhaler, Editors,** Abelian groups and noncommutative rings, 1992

129 **John R. Graef and Jack K. Hale, Editors,** Oscillation and dynamics in delay equations, 1992

128 **Ridgley Lange and Shengwang Wang,** New approaches in spectral decomposition, 1992

127 **Vladimir Oliker and Andrejs Treibergs, Editors,** Geometry and nonlinear partial differential equations, 1992

126 **R. Keith Dennis, Claudio Pedrini, and Michael R. Stein, Editors,** Algebraic K-theory, commutative algebra, and algebraic geometry, 1992

125 **F. Thomas Bruss, Thomas S. Ferguson, and Stephen M. Samuels, Editors,** Strategies for sequential search and selection in real time, 1992

124 **Darrell Haile and James Osterburg, Editors,** Azumaya algebras, actions, and modules, 1992

123 **Steven L. Kleiman and Anders Thorup, Editors,** Enumerative algebraic geometry, 1991

122 **D. H. Sattinger, C. A. Tracy, and S. Venakides, Editors,** Inverse scattering and applications, 1991

121 **Alex J. Feingold, Igor B. Frenkel, and John F. X. Ries,** Spinor construction of vertex operator algebras, triality, and $E_8^{(1)}$, 1991

120 **Robert S. Doran, Editor,** Selfadjoint and nonselfadjoint operator algebras and operator theory, 1991

119 **Robert A. Melter, Azriel Rosenfeld, and Prabir Bhattacharya, Editors,** Vision geometry, 1991

118 **Yan Shi-Jian, Wang Jiagang, and Yang Chung-chun, Editors,** Probability theory and its applications in China, 1991

117 **Morton Brown, Editor,** Continuum theory and dynamical systems, 1991

116 **Brian Harbourne and Robert Speiser, Editors,** Algebraic geometry: Sundance 1988, 1991

115 **Nancy Flournoy and Robert K. Tsutakawa, Editors,** Statistical multiple integration, 1991

114 **Jeffrey C. Lagarias and Michael J. Todd, Editors,** Mathematical developments arising from linear programming, 1990

113 **Eric Grinberg and Eric Todd Quinto, Editors,** Integral geometry and tomography, 1990

112 **Philip J. Brown and Wayne A. Fuller, Editors,** Statistical analysis of measurement error models and applications, 1990

111 **Earl S. Kramer and Spyros S. Magliveras, Editors,** Finite geometries and combinatorial designs, 1990

110 **Georgia Benkart and J. Marshall Osborn, Editors,** Lie algebras and related topics, 1990

109 **Benjamin Fine, Anthony Gaglione, and Francis C. Y. Tang, Editors,** Combinatorial group theory, 1990

108 **Melvyn S. Berger, Editor,** Mathematics of nonlinear science, 1990

107 **Mario Milman and Tomas Schonbek, Editors,** Harmonic analysis and partial differential equations, 1990

106 **Wilfried Sieg, Editor,** Logic and computation, 1990

(See the AMS catalog for earlier titles)

ISBN 0-8218-5040-7