CHEMICAL HERITAGE FOUNDATION

RUDOLPH PARISER

Transcript of an Interview
Conducted by

Arthur Daemmrich and George G. Cremer

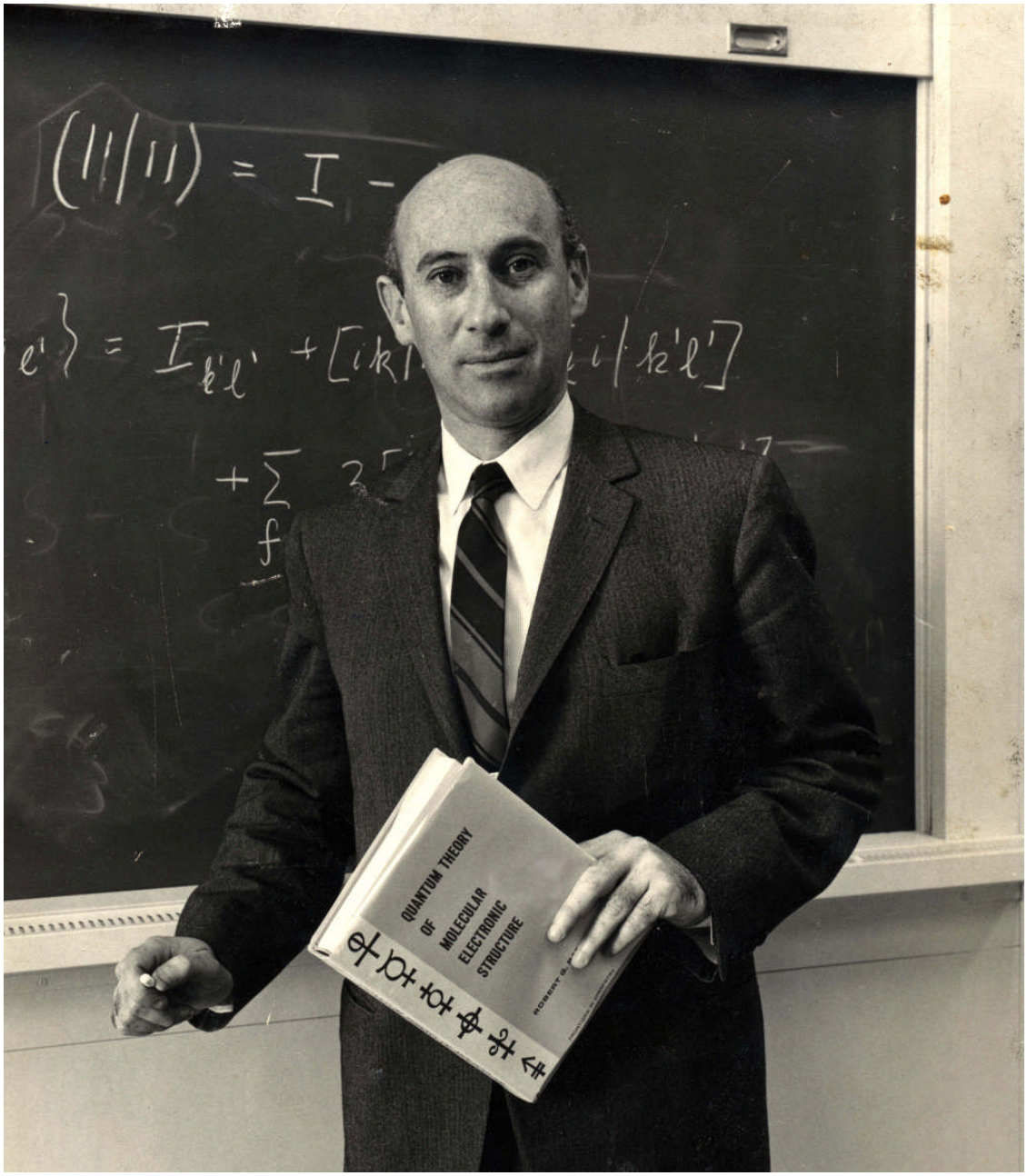
at

Chemical Heritage Foundation
Philadelphia, Pennsylvania

on

28 October 2005

(With Subsequent Corrections and Additions)



Rudolph Pariser

ACKNOWLEDGMENT

This oral history is one in a series initiated by the Chemical Heritage Foundation in honor of E. N. Brandt, an outstanding practitioner of oral history and a leader both in its methods and broader historical context. The series documents the personal perspectives of entrepreneurs, scientists, and managers who have made outstanding contributions to the growth of the American chemical industries during the twentieth century.

This series is made possible through the generosity of The Rollin M. Gerstacker Foundation.

CHEMICAL HERITAGE FOUNDATION
Oral History Program
FINAL RELEASE FORM

This document contains my understanding and agreement with Chemical Heritage Foundation with respect to my participation in an audio recorded interview conducted by Arthur Daemmrich and George Cremer on 28 July 2005. I have read the transcript supplied by Chemical Heritage Foundation.

1. The audio recording, corrected transcript, photographs, and memorabilia (collectively called the "Work") will be maintained by Chemical Heritage Foundation and made available in accordance with general policies for research and other scholarly purposes.

2. I hereby grant, assign, and transfer to Chemical Heritage Foundation all right, title, and interest in the Work, including the literary rights and the copyright, except that I shall retain the right to copy, use, and publish the Work in part or in full until my death.

3. The manuscript may be read and the audio recording(s) heard by scholars approved by Chemical Heritage Foundation subject to the restrictions listed below. The scholar pledges not to quote from, cite, or reproduce by any means this material except with the written permission of Chemical Heritage Foundation.

4. I wish to place the conditions that I have checked below upon the use of this interview. I understand that Chemical Heritage Foundation will enforce my wishes until the time of my death, when any restrictions will be removed.

Please check one:

a. ✓ **No restrictions for access.**
NOTE: Users citing this interview for purposes of publication are obliged under the terms of the Chemical Heritage Foundation Oral History Program to obtain permission from Chemical Heritage Foundation, Philadelphia, Pennsylvania.

b. _____ **Semi-restricted access.** (May view the Work. My permission required to quote, cite, or reproduce.)

c. _____ **Restricted access.** (My permission required to view the Work, quote, cite, or reproduce.)

This constitutes my entire and complete understanding.

(Signature) Rudolph Pariser
Rudolph Pariser

(Date) 4/22/06

Revised 10/11/05

Chemical Heritage Foundation
Oral History Program
315 Chestnut Street
Philadelphia, Pennsylvania 19106

The Chemical Heritage Foundation (CHF) serves the community of the chemical and molecular sciences, and the wider public, by treasuring the past, educating the present, and inspiring the future. CHF maintains a world-class collection of materials that document the history and heritage of the chemical and molecular sciences, technologies, and industries; encourages research in CHF collections; and carries out a program of outreach and interpretation in order to advance an understanding of the role of the chemical and molecular sciences, technologies, and industries in shaping society.

RUDOLPH PARISER

1923	Born in Harbin, China on 8 December

Education

1937-1941	American School in Japan [ASIJ]
1941-1944	B.Sc., chemistry, University of California at Berkeley
1946-1950	Ph.D., physical chemistry, University of Minnesota

Professional Experience

1944-1946	Infantry and Signal Corps, United States Army
	E. I. du Pont de Nemours & Co., Wilmington, Delaware
1950-1954	Research Chemist, Organic Chemicals Department
1954-1959	Research Supervisor, Organic Chemicals Department
1959-1963	Division Head, Elastomer Chemicals Department
1967-1970	Assistant Laboratory Director, Elastomer Chemicals Department
1967-1970	Laboratory Director, Elastomer Chemicals Department
1970-1972	Director, Exploratory Research
1970-1972	Manager, Research and Development, Elastomer Chemicals Department
1972-1974	Manager, Market Research & Market Development, Elastomer Chemicals Department
1974-1979	Director, Pioneering Research, Elastomer Chemicals Department
1980-1981	Research Director, Polymer Products Department
1981-1986	Director, Polymer Science, Central Research & Development Department
1986-1988	Director, Advanced Materials Science, Central Research & Development Department
	R. Pariser & Co., Inc.
1989-present	President

Awards

1957	Delaware Section Award, American Chemical Society
1976	Outstanding Achievement Award, University of Minnesota
1990	International Journal of Quantum Chemistry, April Issue, in honor of Rudolph Pariser, Robert G. Parr, and John A. Pople

2001	Fellow, American Association for the Advancement of Science
2001	Fellow, World Innovation Foundation
2002	Honorary Fellow, World Innovation Foundation
2003	The Lavoisier Medal for Technical Achievement
2004	Emeritus Certificate, Rubber Division, American Chemical Society
2004	Fellow, International Union of Pure and Applied Chemistry

Advisory Boards and Steering Committees

National Research Council, NAS/NAE

1979-1981	Co-chairman, Panel on Polymer Science and Engineering
1979-1982	Committee on Chemical Sciences
1984	Co-chairman, Panel on High Performance Composites
1986-1989	Committee on Materials Science and Engineering
1996-1998	Committee on Fire Suppression Substitutes and Alternatives to Halon

National Science Foundation

1986-1989	Materials Research Advisory Committee
1994	VPI evaluation and site visit
1999	Small Business Innovation Research Program [SBIR]

Chemical Heritage Foundation

2002-present	Executive, Program and Membership Committees, Joseph Priestley Society
2003-present	Executive Committee, Robert Boyle Society
2005-present	Board of Overseers

University Advisory Boards

1980-1997	University of Delaware Research Foundation, Research Committee
1986-1991	Massachusetts Institute of Technology, Department of Mechanical Engineering, DARPA/ONR Program on Structural Polymers
1987-1997	University of Wisconsin, Department of Chemical Engineering
1987-2003	University of Florida, Gainesville, Department of Materials Science
1988-1995	Lehigh University, Department of Materials Science and Engineering
1989-1991	University of Delaware, Chairman, Advisory Committee, Materials Research Symposia
1990	University of Wisconsin, Chairman, Advisory Committee, Department of Chemical Engineering
1990-1996	University of Pennsylvania, School of Dental Medicine
1996-2004	University of Delaware, College of Engineering
2000-2003	North Carolina State University, Raleigh, Department of Chemistry

2000-present	University of Delaware, Department of Materials Science
2001-2003	University of North Carolina, Chapel Hill, Department of Chemistry
2005-present	University of North Carolina, Institute for Advanced Materials
2005-present	University of North Carolina, Chapel Hill, Department of Chemistry

ABSTRACT

Rudolph (Rudy) Pariser was born in Harbin, China on 8 December 1923, to Ludwig Jacob Pariser and Lia Rubinstein. His father was a German POW during World War I, who escaped from his Russian captives near Manchuria while being transported on the Trans-Siberian Railway. He made his way to Harbin, where he became a live-in tutor for the Shapiro family, and ended up eventually taking over their import/export business. Rudy's mother was a refugee of the Russian Revolution and a relative of the Shapiro family. She made her way to Harbin from Estonia after her family's leather factory was destroyed in the Revolution.

Rudy describes his childhood in Harbin as being quite pleasant. His family lived in a very nice apartment, with servants and a boat on the river. He attended a German school in Harbin, the Von Hindenburg Schule. His friends included children from the foreign business community in Harbin, which was reasonably large, as well as Russian refugees who had fled to Harbin from the Revolution. In 1936, Rudy was sent to an American Missionary School in Beijing, where he lived in the dormitories. The school had a rather strict, quite religious atmosphere. In the summer of 1937, the school was destroyed by the invading Japanese.

Rudy's parents next sent him to the American School in Japan, in Tokyo. It was a school of nearly two hundred students, and many of his teachers were recent American college graduates with advanced degrees who had relished the opportunity to come to Japan and teach. While there, Rudy reinforced his interest in chemistry, thanks in part to the influence of his chemistry teacher, David Misner, whose love for the subject was apparent in the way he taught. Rudy was also strongly encouraged by his father, whom he remembers saying, "If I were you, I wouldn't be a businessman. I'd be a chemist."

By the summer of 1941, tension between Japan and the United States was high and Rudy's parents knew that Rudy had to leave for the U.S. to continue his education. They decided to send Rudy to California with his mother, while his father stayed behind with the business in Harbin. The attack on Pearl Harbor, on 7 December 1941, prevented Rudy's mother from returning to China. Rudy attended the University of California at Berkeley and worked as a Russian translator, and later at the Richmond shipyards, to earn money for himself and his mother. He earned a degree in chemical technology from Berkeley in less than three years, where he was taught by renowned professors like Joel Hildebrand, William F. Giauque, Melvin Calvin, and Frank Oppenheimer.

Upon graduation, he began working as a chemist for Kaiser Permanente Mills. He held that job only briefly before his strong feelings about the War got the best of him and he enlisted in the Army. Although he had a college degree in chemistry and could speak multiple languages, Rudy was also very physically fit, and since fitness was of the highest priority in the Army, he was placed in the infantry. There he was trained for the invasion and occupation of Germany, but through a series of errors he was sent to the Signal Corps in Missouri instead of the front lines, and never actually made it to Germany.

After Rudy had completed his military service, he pursued his Ph.D. in chemistry at the University of Minnesota. He trained under Dr. Robert L. Livingston and did his thesis on chlorophyll photosensitized reactions in solutions. Rudy also met Robert G. Parr for the first time at Minnesota, where Parr was finishing up his Ph.D. in 1947, about when Rudy arrived.

Rudy Pariser received his Ph.D. in physical chemistry in 1950, whereupon he began looking for employment. He interviewed at DuPont's Jackson Laboratory, in the Organic Chemicals Department. Though he had been concerned that it would have a "plant" atmosphere, he found the lab to be of a very high scientific caliber. He was offered a Research Chemist position and accepted with pleasure.

One of his first assignments was to examine the stability of whitening agents, and after that work was completed he proposed to work on the relationship between a dye's structure and its color. He remembered that Robert Parr had done his thesis work on calculating the energy levels in ethylene and benzene, and he gained approval to engage Parr as a consultant to help with that project.

In his thesis, Parr pioneered a rigorous quantum mechanical procedure, which was extremely demanding especially in regard to computing inter-electronic repulsion integrals. However, the calculated energy levels were not in satisfactory agreement with experimental values. Soon after commencing their collaboration, Parr discovered the "zero differential overlap approximation" which dramatically simplified the calculation of the repulsion integrals; the same results for benzene as in Parr's thesis could now be calculated very easily. However, in order to achieve agreement with Parr's experiment, Rudy discovered a method for adjusting the values of these integrals, which was based on the use of atomic ionization potentials and electron affinities. Then, taking advantage of IBM's new computer technology, Rudy developed a program to perform such calculations for large molecules very efficiently. He produced results that were in very close agreement with experimental values, and that also predicted as yet undiscovered excited states, such as triplet states. In recognition of subsequent contributions by John Pople, the theory became known as the Pariser-Parr-Pople theory, or PPP theory. The theory continues to receive worldwide recognition.

With the development of PPP theory, Rudy had become well known in the scientific community. At DuPont, he began his rise through the ranks of research management. In 1970, Rudy was promoted to Director of Exploratory Research, Elastomers Department. Under his leadership, his group developed many important products for DuPont, including certain Viton products, and new products like Vamac, Hytrel, and Kalrez. At that time, also reporting to Rudy was Charles J. Pedersen, who was honored with the chemistry Nobel Prize in 1987.

Subsequently, as Science Director of Advanced Materials in Central Research, Rudy's organization discovered and helped to commercialize group transfer polymerization, novel high temperature superconductors, and other electronic and ceramic products.

Rudy's success with products was matched by his skills as a manager. During his long tenure in DuPont management, Rudy mentored many people who became future leaders and

Vice Presidents at DuPont and elsewhere, including Thomas M. Connelly, Uma Chowdhry, and James M. Meyer.

In 2003, Rudy was awarded the Lavoisier Medal, DuPont's highest award for technical achievement.

Rudy retired from DuPont, and in 1989 he formed R. Pariser & Co., Inc., consulting primarily for R&D management. He also remained active on various university advisory boards, such as at the American Chemical Society, the International Union of Pure and Applied Chemistry, and the Chemical Heritage Foundation.

Rudy was married to Louise (formerly Margaret Louise Marsh) in Bermuda in 1972. Louise hails from an old, established family in North Carolina. Although Louise and Rudy were brought up "on opposite sides of the world," their values are extremely compatible. Rudy and his wife reside currently in Hockessin, Delaware.

INTERVIEWERS

Arthur Daemmrich is the director of the Center for Contemporary History and Policy at the Chemical Heritage Foundation. He holds a Ph.D. in science and technology studies from Cornell University and has published on biotechnology policy and politics, the sociology of medicine, and pharmaceutical drug regulation. The projects he supervises at CHF bring long-range perspectives to bear on key issues in innovation, globalization, risk, health, and environmental policy. Daemmrich has held fellowships from the Social Science Research Council/Berlin Program for Advanced German and European Studies, the Kennedy School of Government at Harvard University, and the Chemical Heritage Foundation.

George G. Cremer is a program assistant in the biotechnology program of the Center for Contemporary History and Policy at Chemical Heritage Foundation. He holds a B.A. degree in history from the Richard Stockton College of New Jersey, and is working toward a B.S. in mechanical engineering at Drexel University. Cremer was a member of the oral history program for two years prior to joining the biotechnology program, where he is currently aiding in the research of commercial biotech in the United States from the mid-1970s to the early 1990s.

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

NOTES

1. Frank H. MacDougall, *Thermodynamics and Chemistry* (New York: J. Wiley Publishers, 1926).

2. Rudolph Pariser and Robert L. Livingston, "The Chlorophyll-Sensitized Photo-Oxidation of Phenylhydrazine by Methyl Red. II Reactivity of the Several Forms of Methyl Red," *J. Am. Chem. Soc*. 70 (1948): 1510; "The Pheophytin-Sensitized Photoreduction of p-Dimethylaminoazobenzene by Ascorbic Acid," *J. Am. Chem. Soc*. 78 (1956): 2944; "Some Photochemical Oxidation Reduction Reactions Sensitized by Chlorophyll a and by Pheophytin a," *J. Am. Chem. Soc*. 78 (1956): 2948.

3. See for more information: P. J. Wingate, "The Colorful Du Pont Company," (Wilmington: Serendipity Press, Wilmington, 1982); D. A. Hounshell and J. K. Smith, "Science and Corporate Strategy," (New York: University of Cambridge Press, 1988): 373.

4. Melvin Calvin and H. Ward Alter, "Substituted Stilbenes. I. Absorption Spectra," *J. Chem. Phys.* 19 (1951): 765-767.

5. H. Eyring, J. Walker, and G. E. Kimball, *Quantum Chemistry* (New York: J. Wiley Publishers, 1944).

6. Robert G. Parr and Bryce L. Crawford, "Molecular Orbital Calculations of Vibrational Force Constants. I. Ethylene," (University of Minnesota, 1947) *J. Chem. Phys*. 16 (1948): 526-32; R.G. Parr, D. P. Craig, and R. G. Ross, "Molecular Orbital Calculations of the Lower Excited Electronic Levels of Benzene Configuration Interaction Included," *J. Chem. Phys*. 18 (1950): 1561.

7. See Note 6.

8. See the Chemical Heritage Foundation oral history research file #0320.

9. Rudolph Pariser and Robert G. Parr, "A Semi-Empirical Theory of the Electronic Spectra and Electronic Structure of Complex Unsaturated Molecules. I," *J. Chem. Phys.* 21 (1953): 466-71; "A Semi-Empirical Theory of the Electronic Spectra and Electronic Structure of Complex Unsaturated Molecules. I," *J. Chem. Phys.* 21 (1953): 767-76; Rudolph Pariser, "An Improvement in the π-Electron Approximation in LCAO MO Theory," *J. Chem. Phys.* 21 (1953): 568-69; Rudolph Pariser and Robert G. Parr, "On the Electronic Structure and Electronic Spectra of Ethylene-Like Molecules," *J. Chem. Phys.* 23 (1955): 711-25; Rudolph Pariser, "Theory of the Electronic Spectra and Structure of the Polyacenes and of Alternant Hydrocarbons," 24 (1956): 250-68; "Electronic Spectrum and Structure of Azulene," *J. Chem. Phys.* 25 (1956): 1112-6.

10. Robert G. Parr and Rudolph Pariser, “On the Electronic Structure and Electronic Spectra of Ethylene-Like Molecules,” *J. Chem. Phys.* 23 (1955): 711.

11. Rudolph Pariser, “Theory of the Electronic Spectra and Structure of the Polyacenes and of Alternate Hydrocarbons,” *J. Chem. Phys.* 24 (1956): 250.

12. See Note 9.

13. For example: Howard Simmons, “Pariser-Parr theory: Quantum mechanical integrals from the benzene spectrum,” *J. Chem. Phys.* 40 (1964): 3554-62; H. Simmons and J. K. Williams, “An empirical model for non-bonded H-H repulsion energies in hydrocarbons,” *J. Am. Chem. Soc.* 86 (1864): 3222-6.

14. Rudolph Pariser, “Electronic Spectrum and Structure of Azulene,” *J. Chem. Phys.* 25 (1956): 1112.

15. R. Pariser, S. F. Kurath, and E. Passaglia, “The Dynamic Mechanical Properties of Polyhexene-1,” *J. App. Phys.* 28 (1957): 499; “The Dynamic Mechanical Properties of ‘Hypalon’-20 Synthetic Rubber at Small Strains,” *J. App. Polym. Sci.* 1 (1959): 150-157; R. Pariser and T. P. Yin, “Dynamic Mechanical Properties of Neoprene Type W,” (Contr. No. 114) *J. Appl. Polym. Sci.* 7 (1963): 667-73; “Dynamic Mechanical Properties of Several Elastomers and the Potentialities in Vibration Control Applications,” *J. App. Polym. Sci.* 8 (1964): 2427.

16. R. Pariser and W. J. Remington, “A New Apparatus for Determining the Cell Structure of Cellulose Materials,” *Rubber World* 138 (1958): 261.

17. R. Pariser, E. F. Cluff, and E. K. Gladding, “A New Method for Measuring the Degree of Crosslinking in Elastomers,” *J. Polym. Sci.* XLV (1960): 341; “Neuere Ergebnisse zur Elastomeren-Vernetzung,” *Kunststoffe* 50 (1960): 623.

18. R. Pariser, D.C. England, R. E. Uschold, and H. Starkweather, “Fluoropolymers: Their Development and Performance,” Proceedings of the Robert A. Welch Foundation Conference on Chem. Res. XXVI (1983).

19. R. Pariser and C. A. Aufdermarsh, Jr., “Cis-Polychloroprene,” *J. Polym. Sci.* Part A. 2 (1964): 4727-4733.

20. R. Pariser, H. K. Frensdorff, “Copolymerization as a Markov Chain,” *J. Chem. Phys.* 39 (1963): 2303.

21. Rudolph Pariser, “Improved Process for Manufacture of Thermoplastic Polyurethane Elastomers,” U.S. Patent # 3,385,833. Issued 28 May 1968.

22. See Note 9.

23. Rudolph Pariser, “Creativity at the Crossroads Between Science and Technology,” *CHEMTECH*, 28 (1998): 48.

24. Rudolph Pariser, “Industrial Corporate Research: Perspectives on Innovation,” *Innovation at the Crossroads Between Science and Technology*, (Haifa, Israel: Neaman Press, 1989): 185-197.

25. Rudolph Pariser, et al., “Polymer Science and Engineering: Challenges, Needs, and Opportunities,” (Washington D.C.: National Academy Press, 1981).

26. Rudolph Pariser, et al., “The Department of Energy: Some Aspects of Basic Research in the Chemical Sciences, Part 2,” (Washington D.C.: National Academy Press, 1981).

27. CHEMRAWN VII, “The Chemistry of the Atmosphere: Its Impact on Global Change,” Baltimore, Maryland, 2-6 December 1991; CHEMRAWN XIV, “Toward Environmentally Benign Processes and Products,” Boulder, Colorado, 9-13 June 2001.

INDEX