

CHEMICAL HERITAGE FOUNDATION

RONALD BRESLOW

Transcript of an Interview
Conducted by

Leon Gortler

at

Columbia University, New York City

on

19 March and 9 April 1999

(With Subsequent Corrections and Additions)

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 a tape-recorded interview conducted by Leon Gortler on 19 March and 9 April 1999.

I have read the transcript supplied by Chemical Heritage Foundation.

1. The tapes, 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, and that the interviewer shall retain the right to use the Work without the permission of Chemical Heritage Foundation.
3. The manuscript may be read and the tape(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, PA.

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) Ronald C. Breslow
Ronald C. Breslow

(Date) 7/2/2000
day/month/year

Upon Ronald Breslow's death in 2017, this oral history was designated **Free Access**.

Please note: Users citing this interview for purposes of publication are obliged under the terms of the Chemical Heritage Foundation (CHF) Center for Oral History to credit CHF using the format below:

Ronald C. Breslow, interview by Leon Gortler at Columbia University, New York, New York, 19 March and 9 April 1999 (Philadelphia: Chemical Heritage Foundation, Oral History Transcript # 0181).



Chemical Heritage Foundation
Center for Oral History
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.

RONALD C. BRESLOW

1931 Born in Rahway, New Jersey on 14 March

Education

1952 A.B., chemistry, Harvard University
1953 M.A., medical sciences, Harvard University
1955 Ph.D., chemistry, Harvard University

Professional Experience

1955-1956 National Research Council Fellow, Cambridge University

Columbia University
1956-1959 Instructor, Department of Chemistry
1959-1962 Associate Professor of Chemistry
1962-1967 Professor of Chemistry
1967-present Samuel Latham Mitchell Professor of Chemistry
1992-present University Professor

Honors

1966 Award in Pure Chemistry, American Chemical Society
1966 Fresenius Award, Phi Lambda Upsilon
1969 Baekeland Medal, American Chemical Society
1969 Mark van Doren Medal, Columbia University
1972 Centenary Medal, British Chemical Society
1974 Harrison Howe Award, Rochester Section, American Chemical Society
1977 Remsen Prize, Maryland Section, American Chemical Society
1978 Roussel Prize in Steroids, Roussel-UCLAF, France
1980 James Flack Norris Prize in Physical Organic Chemistry, American Chemical Society
1984 T. W. Richards Medal, Northeast Section, American Chemical Society
1987 Arthur C. Cope Award, American Chemical Society
1988 Kenner Award, University of Liverpool
1989 Nichols Medal, New York Section, American Chemical Society
1989 Award in Chemical Sciences, National Academy of Sciences
1990 Allan Day Award, Philadelphia Organic Chemists Club
1990 Paracelsus Award and Medal, Swiss Chemical Society
1991 National Medal of Science
1999 Priestley Medal, American Chemical Society

ABSTRACT

Ronald Breslow begins the interview with a discussion of his family life and background. He grew up in Rahway, New Jersey, the son of a physician. Max Tishler, a family friend, helped to pique Breslow's interest in chemistry. In high school, Breslow entered the Westinghouse Science Contest, which enabled him to meet like-minded teenagers. Breslow entered Harvard University, graduating with his A.B. in chemistry in 1952. He discusses chemistry courses taught by Louis Fieser and Paul Bartlett, and his research with Gilbert Stork on the structure of cedrene. Breslow received a master's degree in medical science from Harvard in 1953, and he discusses the uniqueness of the program. He continued his graduate studies with R. B. Woodward, earning his Ph.D. in chemistry in 1955 for his work on magnamycin. He discusses his graduate school colleagues and his post-doc with Alexander Todd. In 1956, Breslow joined the faculty of Columbia University, where he has worked on a variety of subjects, including thiamine, cyclopropenyl cation, cyclodextrins, and electron transfer. He discusses his colleagues, his collaborations, and his cancer research. Breslow further addresses changes at Columbia, Columbia's chemistry department, and his involvement in the American Chemical Society. He concludes with a discussion of his consulting activities and reflections on his family and career.

INTERVIEWER

Leon Gortler is Professor of Chemistry at Brooklyn College of the City University of New York. He holds AB and MS degrees from the University of Chicago and a Ph.D. from Harvard University where he worked with Paul Bartlett. He has long been interested in the history of chemistry, in particular the development of physical organic chemistry, and has conducted over fifty oral and videotaped interviews with major American chemists.

TABLE OF CONTENTS

1	Family Background and Education Growing up in Rahway. Father's medical practice. Max Tishler. Growing interest in chemistry. Support of mother. Relationship with sister. Westinghouse Science Contest.
4	College Years Decision to attend Harvard. Louis Fieser. Chemistry courses. Paul Bartlett. Research with Gilbert Stork. Work on structure of cedrene. Entering graduate studies in medical science. Decision to get Ph.D. in chemistry. Research with R.B. Woodward. Structure elucidation of magnamycin. Edwin Ullman. Colleagues. Andrew Kende. Ed Wasserman. Post-doc with Alexander Todd. DNA research.
12	Family Meeting wife [Esther]. Wife's work on base pairing. Children.
15	Chemical Research Job offer from Columbia. Research on thiamine. Physical organic work. Cyclopropenyl anion. Collaborations. Free radical catalysis. Cyclodextrins. Cytochrome P450. Hydrophobicity. Electron transfer. Work with Memorial Sloan-Kettering Cancer Research Institute. Collaboration with National Cancer Institute.
49	Columbia University Controversy over Barnard College. Role in bringing William McGill to Columbia. Changing emphasis to undergraduates. Chairmanship of chemistry department. Improving facilities. Colleagues. Importance of teaching. Publishing.
57	American Chemical Society Becoming president. <i>Chemistry Today and Tomorrow</i> . Importance of public understanding.
60	Conclusion Consulting. DuPont. Schering-Plough. Synvar. General Motors. Board of Rockefeller University. Future of chemical sciences. Hobbies. National Medal of Science. Reflections on research. Relationship with students. Family. Future of physical organic chemistry.
79	Notes
82	Index

NOTES

1. James Bryant Conant and Albert Harold Blatt, *The Chemistry of Organic Compounds. A Year's Course in Organic Chemistry* (New York: Macmillan, 1947).
2. Gilbert Stork and Ronald Breslow, "The Rearrangement of Bromonorcedrenedi carboxylic Acid," *Journal of the American Chemical Society* 75 (1953): 3292.
3. Gilbert Stork and Ronald Breslow, "The Structure of Cedrene," *Journal of the American Chemical Society* 75 (1953): 3291.
4. Ronald Charles David Breslow, "Studies on Magnamycin" (Ph.D. dissertation, Harvard University, 1955).
5. Dorothy Gilner, "Studies on the Biosynthesis of Magnamycin" (Ph.D. dissertation, Columbia University, 1963).
6. Lawrence Stanley Weiler, "Further Studies on Magnamycin" (Ph.D. dissertation, Harvard University, 1968).
7. Esther May Breslow, "Physical Properties of Synthetic Polyribonucleotides" (Ph.D. dissertation, New York University, 1959).
8. Ronald Breslow, "The Mechanism of Thiamine Action," *Chemistry and Industry*, BIF Review, R. 28 (1956).
9. Frank H. Westheimer, interview by Leon Gortler at Harvard University, 4 and 5 January 1979 (Philadelphia: Chemical Heritage Foundation, Oral History Transcript #0046).
10. William H. Hamill, "Micro Analysis for Exchangeable Hydrogen," *Journal of the American Chemical Society* 59 (1937): 1152.
11. Ronald Breslow, "On the Mechanism of Thiamine Action. IV. Evidence from Studies on Model Systems," *Journal of the American Chemical Society* 80 (1958): 3719.
12. Ronald Breslow, "Synthesis of the s-Triphenylcyclopropenyl Cation," *Journal of the American Chemical Society* 79 (1957): 5318.
13. Ronald Breslow, William Bahary, and William Reinmuth, "Concerning the Stability of Some Substituted Cyclopropenyl Radicals; Evidence from Polarography of the Corresponding Cations," *Journal of the American Chemical Society* 83 (1961): 1763.
14. M. Saunders, R. Berger, A. Jaffe, J. M. McBride, J. O'Neill, R. Breslow, J. M. Hoffman,

- Jr., C. Perchonock, E. Wasserman, R. S. Hutton, and V. J. Kuck, "Unsubstituted Cyclopentadienyl Cation, a Ground-State Triplet," *Journal of the American Chemical Society* 95 (1973): 3017.
15. L. P. Le, A. Keren, G. M. Luke, W. D. Wu, Y. J. Uemura, W. S. Jenks, A. Graff, R. Breslow, P. Dosanji, "μSR Studies in an I₂-Doped Phenylenediamine Polymer," *Hyperfine Interactions* 85 (1994): 287-292.
16. R. Breslow, J. T. Groves, S. S. Olin, "A Novel Oxidative Terpene Cyclization," *Tetrahedron Letters* 39 (1966): 4717-4719.
- R. Breslow, S. S. Olin, J. T. Groves, "Oxidative Cyclization of Farnesyl Acetate by a Free Radical Path," *Tetrahedron Letters* 15 (1968): 1837-1840.
17. R. Breslow, R. J. Corcoran, B. B. Snider, "Steroid conversion method and products produced thereby," U.S. patent 4,252,719, February 24, 1981.
- R. Breslow, C. S. Wilcox, "Process for the preparation of steroidal 17 alpha-carboxylates," U.S. patent 4,323,512, April 6, 1982.
- R. Breslow, M. Brandl, A. D. Adams, J. Hunger, "Selective chlorination of steroids and other substrates directed by covalently linked pyridine derivatives acting as templates," U.S. patent 4,920,216, April 24, 1990.
18. Friedrich Cramer, *Einschlussverbindungen* (Berlin: Springer, 1954).
19. R. C. VanEtten, J. F. Sebastian, G. A. Clowes, and M. L. Bender, "Acceleration of phenyl ester cleavage by cycloamyloses," *Journal of the American Chemical Society* 89 (1967): 3242.
20. R. Breslow, Z. Yang, R. Ching, G. Trojandt, F. Odobel, "Sequence Selective Binding of Peptides by Artificial Receptors in Aqueous Solution," *Journal of the American Chemical Society* 120 (1998): 3536-3537.
21. R. Breslow, X. Zhang, Y. Huang, "Selective Catalytic Hydroxylation of a Steroid by an Artificial Cytochrom P-450 Enzyme," *Journal of the American Chemical Society* 119 (1997): 4535-4536.
- R. Breslow, B. Gabriele, J. Yang, "Geometrically Directed Selective Steroid Hydroxylation with High Turnover by a Fluorinated Artificial Cytochrome P-450," *Tetrahedron Letters* 39 (1998): 2887-2890.
22. R. Breslow, "Hydrophobic Effects on Simple Organic Reactions in Water," *Accts. Chem. Res.* 24 (1991): 159-164.

- D. Rideout, R. Breslow, "Hydrophobic Acceleration of Diels-Alder Reactions," *Journal of the American Chemical Society* 102 (1980): 7816-7817.
23. M. Uljana Mayer and Ronald Breslow, "Antihydrophobic Evidence for the Single Electron Transfer Mechanism of Nucleophilic Substitution," *Journal of the American Chemical Society* 120 (1998): 9098-9099.
24. Ronald Breslow, Branco Jursic, Zhong Fa Yan, Eileen Friedman, Lin Leng, Lang Ngo, Richard A. Rifkind, and Paul A. Marks, "Potent cytodifferentiating agents related to hexamethylenebisacetamide," *Proceedings of the National Academy of Sciences* 88 (1991):5542.
25. Ronald Breslow, *Organic Reaction Mechanisms* (New York: W.A. Benjamin, 1966).
26. Ronald Breslow, *Chemistry Today and Tomorrow: The Central, Useful, and Creative Science* (Washington, D.C.: American Chemical Society, 1996).
27. Ronald Breslow, "Interesting Times for Chemistry," *Chemical and Engineering News* (January 1, 1996): 2.
- Ronald Breslow, "Basic Research and Our Economic Future," *Chemical and Engineering News* (February 12, 1996): 79.
- Ronald Breslow, "Getting Our Message Across," *Chemical and Engineering News* (April 15, 1996): 35.
- Ronald Breslow, "Some Challenges for Chemistry," *Chemical and Engineering News* (July 8, 1996): 42.
- Ronald Breslow, "The Greening of Chemistry," *Chemical and Engineering News* (August 26, 1996): 72.

INDEX

A

American Bar Association, 73
American Chemical Society [ACS], 2, 20, 38, 57-58, 66-69
 Public Service Award, 67
 Science Writing Award, 67
American Cyanamid, 62
American Physical Society, 66, 68
Amherst College, 50
Anthracene, 36
Antimonylpentafluoride, 22
Archer, Sydney, 61

B

Baltimore, Maryland, 10, 63
Barnard College, 49-51
Bartlett, Paul D., 5, 7, 11
Barton, Jacqueline K., 54
Barton, Sir Derek H. R., 24
Battiste, Merle A., 20
Bell Laboratories, 22
Bender, Myron L., 26
Benjamin Publishing Company, 56
Benjamin, William, 56-57
Benjamin-Cummings, 57
Bent, Brian E., 54
Benzaldehyde, 34, 36
Benzene di-cations, 21
Benzoin, 16, 18, 34-36
Benzophenone, 24
Benzyl pyridinium, 16
Bergman, Robert G., 57, 72, 74
Berkessel, Albrecht, 72
Berry, R. Stephen, 10
Biochemistry, 5-9, 13, 24, 73, 76
Bio-organic chemistry, 7, 55, 73
Blatt, Albert Harold, 1-2
Brandeis University, 23, 25
Breslow, Ronald
 daughters [Karen and Stephanie], 13-14, 71, 73
 father [Alexander], 1-2, 4, 6, 12, 15, 71
 grandchild, 14
 mother [Gladys], 2, 15
 sister [Diane], 2-3, 15

wife [Esther], 8, 11-15, 27, 63, 70-71, 73-74
Bromonorcedrene dicarboxylic acid, 6
Brown, George E., Jr., 67
Browne, Malcolm W., 59
Bush, President George Herbert Walker, 71

C

California, University of , San Diego, 51
Cambridge, England, 15
Carbenes, 22
Catalysts, 16, 25, 28-30, 75
Cedrene, 5-6
Chemical and Engineering News, 58-59, 66
Chemistry & Industry, 16-17
Chicago, University of, 10, 65
Chin, Jik, 72
Chmielewski, Jean A., 72
Clinton, Chelsea, 59
Clinton, President William Jefferson, 59
Cohen, --, 46
Cologne, University of, 72
Columbia University, 1, 9, 13, 15, 32, 41, 49-52, 63, 66
 Chandler Laboratory, 53
 Faculty Committee, 51
 Havemeyer Building, 53
 law school, 13-14
 Student Committee, 51
 Trustees' Committee, 51
Colwell, Rita R., 59
Committee on Professional Training, 76
Conant, James Bryant, 1-2
Corey, Elias James, 25, 63, 75
Cornell University, 11, 13-15
 Medical College, 13, 73
Corticosteroids, 24-25
Cortisone, 25, 75
Council of Chemical Research, 76
Cram, Donald J., 20
Cramer, Friedrich, 26
Cyanohydrin anion, 34
Cyclobutadiene, 21
Cyclodextrins, 26-30, 32, 71
Cyclohexane, 35
Cyclohexylmethyl iodide, 38
Cyclooctatetraene dianion, 20

Cyclopentadiene, 35-36
Cyclopentadienyl cation, 21-22
Cyclopropenyl anions, 20-22
Cyclopropenyl cation, 18, 20
Cytochrome P450, 28

D

Daley, Benjamin, 17
Danishefsky, Samuel, 76
Dartmouth College, 48
Deoxyribonucleic acid [DNA], 12, 76
Dervan, Peter B., 68
Deuterium, 16-17, 19
Dewar, Michael James Stuart, 40
DeWitt Wallace Research Labs, 41
Dicarboxylic acid, 5, 45
Diels-Alder reaction, 19, 32, 34-36
Dimethylacetamide, 42
Dimethylsulfoxide, 37, 42
Disulfonylchloride, 30
Djerassi, Carl, 10, 61
Domenici, Pete V., 59
Doty, Paul M., 6
Du Pont de Nemours & Co., E. I., 15-16, 60-61, 63

E

Eastwood, Clint, 14, 73
Electrochemistry, 21-22, 71
Electron spin resonance [ESR], 22, 62-63
Electrostriction, 33
Eliel, Ernest L., 66
Engberts, --, 32
Erythrocytes, 41-43
Erythroleukemia, 42
Erythromycin, 9
Ethanol, 33-38, 40
Ethylene oxide, 35

F

Farnesol, 6
Federation of American Societies for Experimental Biology [FASEB], 67-68
Ferromagnetism, 23
Fieser, Louis Frederick, 4-5
Food and Drug Administration [FDA], 47
Fordham University, 18

Friend Cells, 41
Friend, Charlotte, 41-43
Friesner, Richard, 40
Frosch, Robert A., 63

G

Gellman, Samuel H., 72
General Motors, 63
 Product Evaluation Program, 63
Gilner, Dorothy, 9
Goldstein, Joseph, 65
Gore, Vice President Albert Arnold, Jr., 59
Goucher College, 50
Gramm, Phil, 69
Gray, Harry, 54
Grieco, Paul A., 32
Groves, John T., 72
Grubbs, Robert H., 72

H

Hager, Lowell P., 26
Halocyclopentadiene, 22
Hammett, Louis Planck, 15-16, 54
Harvard University, 4, 6-8, 10-11, 13-14, 49, 52, 55, 65
 medical school, 6
Hexaazaoctadecahydrocoronene [HOC], 23
Hexachlorobenzene, 22
Hexamethylenebisacetamide, 43-44
Hexamethylenediamine, 43
HIV integrase, 27
HIV protease, 27
Hoffmann, Roald, 55
Houston, Texas, 52
Hückel rule, 20, 28
Hydrocarbons, 27, 33-38, 40
Hydrophobicity, 27, 30, 32-39, 42, 45-46, 74
Hydroxamic acid, 45
Hydroxylamine, 37

I

Illinois, University of, 26, 72
Infrared spectrometer, 17
Ingold, Sir Christopher, 20
Internal Revenue Service [IRS], 63
International College of Surgeons, 1

Iowa, University of, 23

J

Jacobs, Madeleine, 58

Jaguar, 40

Jencks, William, 23

Jenks, William S., 23

Johns Hopkins University, 50

Johnson, William, 15

Jones & Bartlett, 58

Jorgensen, William L., 40

Journal of the American Chemical Society, 38

K

Kahne, Daniel, 76

Kaiser, Thomas, 64-65

Karplus, Martin, 56

Katz, Thomas J., 55

Kende, Andrew S., 10

Klemperer, Walter G., 54

Knowles, Jeremy R., 52

Kool, Eric T., 34

Korean War, 12

Kuhne, Martin, 9

L

La Jolla, California, 51

Lane, Neal F., 69

Langenbeck, --, 16

Las Vegas, Nevada, 14

Lederle Laboratories, Inc., 11

Lee, Tsung-Dao, 23

Lemieux, Raymond U., 76

Leukemia, 42-44, 48

Lewis acid, 22

Lieberman, Joseph, 69

Lippard, Steven, 54

Lippman, Fritz, 26

Lithium perchlorate, 34

Lithocholic acid, 29

Little, William, 62

M

M*A*S*H, 1
Magnamycin, 8-10
Mandelonitrile anion, 34
Marks, Paul A., 41-42
Martha's Vineyard, 57
Massachusetts Institute of Technology [MIT], 11, 55
McBride, Michael, 22
McGill University, 10
McGill, William J., 51-52
McNelis, Edward J., 20
Memorial Sloan-Kettering Cancer Research Institute, 41
Merck & Co., 1, 73
Meta-nitrophenylacetate, 26
Methylene, 16, 43, 45
Missouri, University of, 20
Moffett, William, 10
Monohalocyclopentadienes, 22
Mount Holyoke College, 50
Mt. Sinai Medical School, 41
Muons, 23
Museum of Natural History, 4
 Young Astronomers Club, 4

N

Nakanishi, Koji, 53
Naphthalene, 20
National Cancer Institute [NCI], 31, 45-46, 48-49
National Institutes of Health [NIH], 67-69, 75
National Medal of Science, 66, 71
National Science Foundation [NSF], 59, 69
New York Times, 59
New York University [NYU], 13, 20
New York, New York, 1, 3-4, 13-15, 32, 50-52, 54, 65, 73
Nitrosomethylurea, 46
N-methylaniline, 37
N-methylmaleimide, 36
Nobel Prize, 23, 63, 66
Norcedrene icarboxylic acid, 5
Notre Dame, University of, 50
Nuclear magnetic resonance [NMR], 17, 22, 30
Nylon, 43

O

Ochoa, Severo, 13
Organic chemistry, 1, 4-5, 7, 40-41, 55, 62, 74-76
Overman, Larry E., 27, 71
Oxirane, 35

P

Palo Alto, California, 61
Paul, Weiss, Rifkind, Wharton & Garrison, 14
Pauling, Linus, 66
Pentaphenylcyclopentadienyl cation, 22
Phenoxide anion, 37, 39
Photochemistry, 24-25
Physical chemistry, 5, 10, 56, 74
Polymers, 25, 74, 76
Porter, George, 67
Priestley Medal, 55, 59, 63, 77
Princeton University, 72
Princeton, New Jersey, 63
Project HOPE, 1
Propionic acid, 9
Purdue University, 72
Pyridine, 19, 46
Pyridine 2-carboxylic acid, 19
Pyridinium, 19
Pyridoxamine, 26, 30
Pyrimidine, 18

R

Radcliffe College, 49-50
Radicals, 24, 39, 71
Rahway, New Jersey, 1, 4
Reinmuth, William H., 21-22
Rensselaer, New York, 61
Rice University, 52
Richards, Frederic Middlebrook, 7
Rifkind, Richard A., 14, 41
Roberts, John D., 20, 57
Rockefeller University, 26, 64-65, 69
Rockefeller, David, 65
Roush, William, 76
Royal Society of Chemistry, 66
Rupp, George, 52

S

Saint Mary's College, 50
Saskatoon, Saskatchewan, 73
Saunders, Martin, 11, 21-22
Schepartz, Alanna, 72
Schering-Plough Corporation, 61, 69
Schleyer, Paul von Rague, 11
Schreiber, Stuart L., 68
Schultz, Peter, 68
Serb Chemical Society, 70
Simmons, Howard E., 60
Snider, Barry B., 25, 75
Sony Pictures, 14, 73
Sovern, Michael I., 52
Squalene, 23-24
Srinivasan, P. R., 9
St. Louis, Missouri, 20
Stanford University, 55, 62
State University of New York, Stonybrook, 33
Sterling Winthrop, 61
Steroids, 24, 28, 30, 61
Stonybrook, New York, 3
Stork, Gilbert, 5, 8, 11, 15-17
Suberic acid, 45
Suberoyl anilide hydroxamate, 45-46, 48
Syntex, 10, 61-63
Synthesis, 8, 10, 25, 32, 61, 75
Synthetic Varnish, 10, 63
Synvar, 10, 61, 63
Syva, 10, 63

T

Tetrahedron, 64
Thiamine, 7, 12, 16-18, 20, 26, 61
Thiazolium, 16-19
Thiophenoxide, 38-39
Tishler, Max, 1-2
Todd, Alexander Robertus, 9, 11-12, 26
Tosylchloride, 30
Triphenylcyclopropenium cation, 20
Tropylium, 20
Turro, Nicholas J., 24

U

U.S. Army, 1-2
U.S. Congress, 58, 66-69
U.S. Senate, 59
 Finance Committee, 59
Uemura, Yasutomo J., 23
Ullman, Edwin F., 8, 10-11, 62
Urey, Harold Clayton, 19

V

Vancouver, British Columbia, 23
Varian Medical Systems, 10, 61-63
Varmus, Harold E., 68
Vermont, University of, 9
Vietnam War, 62
Vitamin B₁, 19
Vitamin B₁₂, 11

W

Washington, D.C., 4, 10, 59, 67
Wasserman, Ed, 11, 21-22
Weiler, Lawrence Stanley, 9-10
Westheimer, Frank H., 7-8, 16-18
Westinghouse Science Contest, 4, 10
White House, 71
Whitesides, George M., 57
Winnick, Mitchell A., 25
Winstein, Saul, 38
Winter, Rudolph Ernst Karl, 20
Wisconsin, University of, 15, 72
Wishnia, Arnold, 33
Woodward, Robert Burns, 5, 7-11, 17, 20
World War II, 1-2

Y

Yale University, 7, 22, 40, 72

Z

Zimmerman, Steven C., 72