

## AWARD OF THE TETRAHEDRON PRIZE FOR CREATIVITY IN ORGANIC CHEMISTRY FOR 1985

The Executive Board of Editors for Tetrahedron Publications is pleased to announce that the 1985 Tetrahedron Prize has been awarded to Professor GILBERT STORK of Columbia University.

Professor Stork is well known for his fundamental contributions to the total synthesis of complex Natural Products. He is specially noted for his many original synthetic methods invented specially to arrive at his stated synthetic objectives. There follows a brief Curriculum Vitae and a list of his elegant and important publications.

### RULES

The Tetrahedron Prize for Creativity in Organic Chemistry was founded in 1980 by the Executive Board of Editors and the Publisher of Tetrahedron Publications. It is intended to honour the memory of the founding co-Chairmen of these publications, Professor Sir Robert Robinson and Professor Robert Burns Woodward.

The Prize, which consists of an appropriate gold medal and citation as well as \$10,000, is awarded every two years to an Organic Chemist who has contributed original ideas to Organic Chemistry.

The Jury is made up of the Executive Board of Editors of Tetrahedron Publications. Consulting Editors, who do *not* have executive function, do not vote for the Prize but are eligible as candidates.

Nominations for the next Prize with a brief citation of their basis, should be sent to Professor Sir Derek Barton, FRS, Director, Institut de Chimie des Substances Naturelles, CNRS, 91190 Gif-sur-Yvette, France, by the end of December 1986. The names of two Referees should be added. Members of the Executive Board cannot make nominations nor act as Referees.

Apart from the reservations made above there are no restrictions of age, nationality or sex for the award of the Tetrahedron Prize.

### JURY

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The Editorial Board



Professor Gilbert Stork

# GILBERT STORK

## EUGENE HIGGINS PROFESSOR OF CHEMISTRY

Columbia University,  
New York, NY 10027, U.S.A.

Ph.D., University of Wisconsin, 1945. D.Sc. (Hon.), Lawrence University (1961). D.Sc. (Hon.), Université Pierre et Marie Curie, Paris (1979). D.Sc. (Hon.), University of Rochester (1982). Harvard University: Instructor, 1946; Assistant Professor, 1948. Columbia University: Associate Professor, 1953; Professor, 1955; Eugene Higgins Professor, 1967–to date.

Member: National Academy of Sciences (1961); American Academy of Arts and Sciences (1962). Honorary Member The Chemist Club of New York. Honorary Member of the Pharmaceutical Society of Japan (1983). Honorary Fellow of the Royal Society of Chemistry (1983).

### AWARDS

Award in Pure Chemistry of the American Chemical Society (1957). Guggenheim Foundation Fellow (1959). Backland Medal of the North Jersey Section, American Chemical Society (1961). Harrison Howe Award (1962). Edward Curtis Franklin Memorial Award, Stanford University (1966). American Chemical Society Award for Creative Work in Synthetic Organic Chemistry (1967). Synthetic Organic Chemical Manufacturers Association Gold Medal (1971). Nebraska Award (1973). Roussel Prize, Paris (1978). Nichols Medal, New York ACS (1980). Arthur C. Cope Award, ACS (1980). Edgar Fahs Smith Award (1982). Willard Gibbs Medal (1982). National Academy of Sciences Award in Chemical Sciences (1982). National Medal of Science (1983). Pauling Award (1983).

### PLENARY AND SPECIAL LECTURES SINCE 1980

*1980:* Sandin Lectures, University of Alberta. *1981:* Frank Mathers Lectures, University of Indiana; Synthesis in Organic Chemistry, Oxford; Woodward Memorial Symposium, ACS; WHO Symposium on Natural Products, Shanghai. *1982:* Greater Manchester Lecturer (Manchester); Lemieux Lecturer, University of Ottawa; H. Martin Friedman Lecturer, Rutgers (Newark); Euchem Symposium on Methods in Organic Synthesis, Louvain-la-Neuve; IUPAC Meeting on Synthetic Organic Chemistry (Tokyo and Sapporo). *1983:* Distinguished Lecturer, University of Texas; Mack Lecturer, Ohio State; Plenary Lecturer at the Bachmann Symposium, University of Michigan; the Italian Chemical Society Summer School of Gargagno and the Hoechst Workshop (Reisensburg). *1984:* Plenary Lecturer Japanese Chemical Society (Tokyo) and Pharmaceutical Society (Sendai); Syntex — University of Tennessee Lecturer in Synthetic Organic Chemistry (Knoxville); Lecturer, Cope Award Symposium (Philadelphia). H. C. Brown Lecturer at Purdue; Plenary Lecturer Twenty-fifth Anniversary Meeting of the Institute for the Study of Natural Products (Gif, France) and at the journées de chimie organique at the Symposium in honour of the retirement of Joseph Fried at the University of Chicago.

# GILBERT STORK

## PUBLICATIONS

1. The synthesis of 3,4-diaminocarbethoxy-furan. G. Stork, *J. Am. Chem. Soc.* **67**, 884 (1945).
2. Piperidine derivatives. XV. Preparation of 1-benzoyl-3-carbethoxy-4-piperidone. A synthesis of guvacine. S. M. McElvain and G. Stork, *J. Am. Chem. Soc.* **68**, 1049 (1946).
3. Piperidine derivatives. XVI. C-Alkylation of 1-benzoyl-3-carbethoxy-4-piperidone. Synthesis of *dl*-ethyl cincholoiponate. G. Stork and S. M. McElvain, *J. Am. Chem. Soc.* **68**, 1053 (1946).
4. The preparation of  $\beta$ -tetralone by the catalytic reduction of  $\beta$ -naphthol. G. Stork and E. L. Foreman, *J. Am. Chem. Soc.* **68**, 2172 (1946).
5. The base effect in catalytic hydrogenation. A simple synthesis of 6-methoxy- $\alpha$ -tetralone. G. Stork, *J. Am. Chem. Soc.* **69**, 576 (1947).
6. Preparation of ethyl- $\beta$ -benzylaminopropionate and benzyl di( $\beta$ -carbethoxyethyl)amine. G. Stork and S. M. McElvain, *J. Am. Chem. Soc.* **69**, 971 (1947).
7. Sex hormones. A synthesis of 1-keto-7-methoxy-1,2,3,4-tetrahydrophenanthrene and of 1-keto-8-methoxy-1,2,3,4,9,10-hexahydrophenanthrene. G. Stork, *J. Am. Chem. Soc.* **69**, 2936 (1947).
8. Configuration of the C/D ring junction in equilenin and other steroids. G. Stork and G. Singh, *Nature* **165**, 816 (1950).
9. The structure of phenolic dihydrothebaine and of  $\beta$ -dihydrothebaine, G. Stork, *J. Am. Chem. Soc.* **73**, 504 (1951).
10. A new route to hydrophenanthrene ketones. The synthesis of the C<sub>18</sub> ketone derived from dehydroabiatic acid. G. Stork and A. W. Burgstahler, *J. Am. Chem. Soc.* **73**, 3544 (1951).
11. Steroids. XXIV. Introduction of the 11-keto and 11 $\alpha$ -hydroxy groups into ring C-unsubstituted steroids; Part I. G. Stork, J. Romo, G. Rosenkranz and C. Djerassi, *J. Am. Chem. Soc.* **73**, 3546 (1951).
12. Steroids. XXVIII. Introduction of the 11-keto and 11 $\alpha$ -hydroxy groups into ring C-unsubstituted steroids; Part II. C. Djerassi, O. Mancera, G. Stork and G. Rosenkranz, *J. Am. Chem. Soc.* **73**, 4496 (1951).
13. Cantharidin. A stereospecific total synthesis. G. Stork, E. E. van Tamelen, L. J. Friedman and A. W. Burgstahler, *J. Am. Chem. Soc.* **73**, 4501 (1951).
14. Skatylmalonic ester. G. Stork and G. Singh, *J. Am. Chem. Soc.* **73**, 4742 (1951).
15. The synthesis of 1-substituted-7,8-dimethoxy-2-tetralones. G. Stork and H. Conroy, *J. Am. Chem. Soc.* **73**, 4743 (1951).
16. Elaboration of 1-substituted-7,8-dimethoxy-2-tetralones toward the 13-alkyl hydrophenanthrene system of morphine. G. Stork and H. Conroy, *J. Am. Chem. Soc.* **73**, 4748 (1951).
17. The reduction of thebaine. G. Stork, *J. Am. Chem. Soc.* **74**, 768 (1952).
18. Introduction of the 11-keto and 11 $\alpha$ -hydroxy groups into ring C-unsubstituted steroids. Part 4. Saturated 7,11-diones. J. Romo, G. Stork, G. Rosenkranz and C. Djerassi, *J. Am. Chem. Soc.* **74**, 2918 (1952).
19. Introduction of the 11-keto and 11 $\alpha$ -hydroxy groups into ring C-unsubstituted steroids. Part 5.  $\Delta^8$ -7-Ketones. C. Djerassi, O. Mancera, M. Valasco, G. Stork and G. Rosenkranz, *J. Am. Chem. Soc.* **74**, 3321 (1952).
20. The morphine alkaloids: Part II. In Manske and Holmes, *The Alkaloids*, Vol. II. Academic Press, New York (1952).
21. Chemistry and biochemistry of adrenocorticosteroids. Synthesis of 11-oxygenated steroids from plant sources. G. Rosenkranz, F. Sondheimer, O. Mancera, J. Pataki, H. J. Ringold, J. Romo, C. Djerassi and G. Stork, in *Recent Progress in Hormone Research*, Vol. VIII (1953).
22. A stereospecific synthesis of cantharidin. G. Stork, E. E. van Tamelen, L. J. Friedman and A. W. Burgstahler, *J. Am. Chem. Soc.* **75**, 384 (1953).
23. Synthesis and reactions of 1-methyl-2-vinyl-4-hydroxycyclohexene. G. Stork, S. S. Wagle and P. C. Mukharji, *J. Am. Chem. Soc.* **75**, 3197 (1953).
24. The structure of cedrene. G. Stork and R. Breslow, *J. Am. Chem. Soc.* **75**, 3291 (1953).
25. The rearrangement of bromonoredenedicarboxylic acid. G. Stork and R. Breslow, *J. Am. Chem. Soc.* **75**, 3292 (1953).
26. The stereochemistry of the S<sub>N</sub>2' reaction. G. Stork and W. N. White, *J. Am. Chem. Soc.* **75**, 4119 (1953).
27. The structure of metopon. G. Stork and L. Bauer, *J. Am. Chem. Soc.* **75**, 4373 (1953).
28. The stereospecific synthesis of *dl*-alloyohimbane and *dl*-3-epi alloyohimbane. G. Stork and R. K. Hill, *J. Am. Chem. Soc.* **76**, 949 (1954).
29. A new synthesis of 2-alkyl and 2-acyl ketones. G. Stork, R. Terrell and J. Szumskovicz, *J. Am. Chem. Soc.* **76**, 2029 (1954).
30. The total synthesis of cedrol and cedrene. G. Stork and F. H. Clarke, *J. Am. Chem. Soc.* **77**, 1072 (1955).
31. The stereochemistry of polyene cyclization. G. Stork and A. W. Burgstahler, *J. Am. Chem. Soc.* **77**, 5068 (1955).
32. L'hydroxycarbonylation dans la synthèse de cyclonones polycycliques. G. Stork, *Bull. Soc. Chim. Fr.* 256 (1955).
33. The racemization of usnic acid. G. Stork, *Chem. Ind.* 915 (1955).
34. The total synthesis of *dl*-dehydroabiatic acid. G. Stork and J. W. Schulenberg, *J. Am. Chem. Soc.* **78** (1956).
35. A total synthesis of 11-oxygenated steroids. G. Stork, H. J. E. Loewenthal and P. C. Mukharji, *J. Am. Chem. Soc.* **78** (1956).
36. The stereochemistry of the S<sub>N</sub>2' reaction. I. Preparation of pure *trans*-6-alkyl-2-cyclohexen-1-ols. G. Stork and W. N. White, *J. Am. Chem. Soc.* **78**, 4604 (1956).
37. The stereochemistry of the S<sub>N</sub>2 reaction. II. G. Stork and W. N. White, *J. Am. Chem. Soc.* **78**, 4604 (1956).
38. The S<sub>N</sub>2' reaction. III. Structure and S<sub>N</sub>2' reaction of the halocodides. G. Stork and F. H. Clarke, *J. Am. Chem. Soc.* **78**, 4619 (1956).
39. A new alkylation of carbonyl compounds, II. G. Stork and H. K. Landesman, *J. Am. Chem. Soc.* **78**, 5128 (1956).

Publications

40. A new ring enlargement sequence. G. Stork and H. K. Landesman, *J. Am. Chem. Soc.* **78**, 5129 (1956).
41. Method for the production of  $\alpha$ -substituted organic carbonyl compounds. G. Stork, U.S. Patent No. 2,773,087 (1956).
42. Method for the preparation of  $\alpha$ -substituted carbonyl compounds. G. Stork, U.S. Patent No. 2,773,099 (1956).
43. The stereospecific synthesis of *dl*-alloyohimbane and *dl*-3-epialloyohimbane. G. Stork and R. K. Hill, *J. Am. Chem. Soc.* **79**, 495 (1957).
44. The steric course of acid-catalyzed cyclizations in terpenoid polyenes. The stereochemistry of the bicyclopimaric acids. P. A. Stadler, A. Eschenmoser, H. Schinz and G. Stork, *Helv. Chim. Acta* **40**, 2191 (1957).
45. Steroids. SCIII. Introduction of the cortical hormone side-chain. H. J. Ringold and G. Stork, *J. Am. Chem. Soc.* **80**, 250 (1958).
46. Synthesis of 17,18-bisnorsteroids. G. Stork, H. N. Khastgir and J. Solo, *J. Am. Chem. Soc.* **80**, 6457 (1958).
47. Enamines as synthetic tools. G. Stork, Abstracts of XVth National Organic Chemistry Symposium, Seattle, June (1959).
48. The morphine alkaloids, Part III. In Manske, *The Alkaloids*, Vol. VI, Chap. 7. Academic Press, New York (1960).
49. The stereochemistry of allogibberic acid and of gibberic acid. G. Stork and H. Newman, *J. Am. Chem. Soc.* **81**, 3168 (1959).
50. The total synthesis of a naturally occurring pentacyclic triterpene system. G. Stork, J. E. Davies and A. Meisels, *J. Am. Chem. Soc.* **81**, 5516 (1959).
51. The stereochemistry of gibberellic acid. G. Stork and H. Newman, *J. Am. Chem. Soc.* **81**, 5518 (1959).
52. Stereospecific reaction of carbon monoxide. G. Stork and M. Bersohn, *J. Am. Chem. Soc.* **82**, 1261 (1960).
53. Stereochemistry of the lithium ammonia reduction of  $\alpha,\beta$ -unsaturated ketones. G. Stork and S. D. Darling, *J. Am. Chem. Soc.* **82**, 1512 (1960).
54. The synthesis of substituted 1-methylcyclohexanecarboxylic acids and the stereochemistry of the Favorskii rearrangement. G. Stork and I. J. Borowitz, *J. Am. Chem. Soc.* **82**, 4307 (1960).
55. Synthesis and reactions of glycidonitriles. Transformation into  $\alpha$ -haloacyl compounds and aminoalcohols. G. Stork, W. S. Worrall and J. J. Pappas, *J. Am. Chem. Soc.* **82**, 4315 (1960).
56. The alkylation of enamines from  $\alpha,\beta$ -unsaturated ketones. G. Stork and G. Birnbaum, *Tetrahedron Lett.* 313 (1961).
57. Lithium-ammonia reduction of  $\alpha,\beta$ -unsaturated ketones (II). Formation and alkylation of a  $\beta$ -carbanion intermediate. G. Stork and J. Tsuji, *J. Am. Chem. Soc.* **83**, 2783 (1961).
58. The  $\alpha$ -alkylation of enolates from the lithium-ammonia reduction of  $\alpha,\beta$ -unsaturated ketones. G. Stork, P. Rosen and N. L. Goldman, *J. Am. Chem. Soc.* **83**, 2965 (1961).
59. Cedrol: stereochemistry and total synthesis. G. Stork and F. H. Clarke, Jr., *J. Am. Chem. Soc.* **83**, 3114 (1961).
60. Intramolecular cyclization of unsaturated diazoketones. G. Stork and J. Ficini, *J. Am. Chem. Soc.* **83**, 4678 (1961).
61. The total synthesis of *dl*-dehydroabiatic acid. G. Stork and J. W. Schulenberg, *J. Am. Chem. Soc.* **84**, 284 (1962).
62. Four-membered sulfones from enamines and aliphatic sulfonyl halides. G. Stork and I. J. Borowitz, *J. Am. Chem. Soc.* **84**, 313 (1962).
63. A stereospecific total synthesis of griseofulvin. G. Stork and M. Tomasz, *J. Am. Chem. Soc.* **84**, 310 (1962).
64. A stereospecific total synthesis of 18-substituted steroids. Application to the synthesis of *dl*-conessine. G. Stork, S. D. Darling, I. T. Harrison and P. S. Wharton, *J. Am. Chem. Soc.* **84**, 2018 (1962).
65. The enamine alkylation and acylation of carbonyl compounds. G. Stork, A. Brizzolara, H. Landesman, J. Szmuskovicz and R. Terrell, *J. Am. Chem. Soc.* **85**, 207 (1963).
66. A new method for the alkylation of ketones and aldehydes. G. Stork and S. Dowd, *J. Am. Chem. Soc.* **85**, 2178 (1963).
67. The total synthesis of *dl*-aspidospermine and *dl*-quebrachamine. G. Stork and J. Dolfini, *J. Am. Chem. Soc.* **85**, 2872 (1963).
68. Total synthesis of polycyclic triterpenes: the total synthesis of (+)- $\alpha$ -onocerin. G. Stork, A. Meisels and J. Davies, *J. Am. Chem. Soc.* **85**, 3419 (1963).
69. Optical rotatory dispersion studies, XCII. Some observations on the conformation of *cis*-10-methyl-2-decalones. C. Djerassi, J. Burakevich, J. W. Chamberlin, D. Elad, T. Toda and G. Stork, *J. Am. Chem. Soc.* **86**, 465 (1964).
70. A new synthesis of cyclohexenones: the double Michael addition of vinyl ethynyl ketones to active methylene compounds. Applications to the total synthesis of *dl*-griseofulvin. G. Stork and M. Tomasz, *J. Am. Chem. Soc.* **86**, 471 (1964).
71. A synthesis of 1,4- and 1,5-diketones. G. Stork and R. Borch, *J. Am. Chem. Soc.* **86**, 936 (1964).
72. A synthesis of *cis*-jasnone. G. Stork and R. Borch, *J. Am. Chem. Soc.* **86**, 936 (1964).
73. The stereochemistry of the lithium-ammonia reduction of  $\alpha,\beta$ -unsaturated ketones. G. Stork and S. D. Darling, *J. Am. Chem. Soc.* **86**, 1761 (1964).
74. Une nouvelle synthèse d'acides éthyleniques par réarrangement d' $\alpha$ -halogène  $\alpha$ -sulfonylcyclanones. G. Stork and J. Ficini, *Bull. Soc. Chim. Fr.* 723 (1964).
75. Progress in the synthesis of polycyclic natural products. G. Stork, *Pure Appl. Chem.* **9**, 131 (1964).
76. Alkylation and carbonation of ketones by trapping enolates from the reduction of  $\alpha,\beta$ -unsaturated ketones. G. Stork, P. Rosen, N. Goldman, R. V. Coombs and J. Tsuji, *J. Am. Chem. Soc.* **87**, 275 (1965).
77. A new cyclization: 2-methylenecyclopentanols by the chemical reduction of  $\gamma$ -ethynyl ketones. G. Stork, S. Malhotra, H. Thompson and M. Uchibayashi, *J. Am. Chem. Soc.* **87**, 1148 (1965).
78. Total synthesis of cephalosporins I. G. Stork and H. T. Cheung, *J. Am. Chem. Soc.* **87**, 3783 (1965).
79. Progress in synthetic organic chemistry. G. Stork, XIXth Organic Symposium, Tempe, Arizona (1965).
80. A method for the transformation of cyclic ketones to homologous  $\alpha,\beta$ -unsaturated ketones. G. Stork, M. Nussim and B. August, *Tetrahedron Suppl.* **8**, Part I, 105 (1966).
81. The isoxazole annelation reaction. A method for the construction of cyclohexenone rings in polycyclic systems. G. Stork, S. Danishefsky and M. Ohashi, *J. Am. Chem. Soc.* **89**, 5459 (1967).
82. Transformation of 4-(3-oxoalkyl)isoxazoles into pyridines. M. Ohashi, H. Kamachi, H. Kakisawa and G. Stork, *J. Am. Chem. Soc.* **89**, 5460 (1967).
83. A general synthesis of 4-isoxazolecarboxylic acids. G. Stork and J. E. McMurry, *J. Am. Chem. Soc.* **89**, 5461 (1967).

84. The mechanism of the isoxazole annelation. G. Stork and J. E. McMurry, *J. Am. Chem. Soc.* **89**, 5463 (1967).
85. Stereospecific total synthesis of steroids via isoxazole annelation *dl*- $\Delta$ -homotestosterone and *dl*-progesterone. G. Stork and J. E. McMurry, *J. Am. Chem. Soc.* **89**, 5464 (1967).
86. The stereospecific total synthesis of *dl*-lycopodine. G. Stork, R. A. Kretschmer and R. H. Schlessinger, *J. Am. Chem. Soc.* **90**, 1647 (1968).
87. Isolation of ketone enolates as trialkylsilyl ethers. G. Stork and P. F. Hudrlik, *J. Am. Chem. Soc.* **90**, 4462 (1968).
88. Generation, nuclear magnetic resonance spectra and alkylation of enolates from trialkylsilyl enol ethers. G. Stork and P. F. Hudrlik, *J. Am. Chem. Soc.* **90**, 4464 (1968).
89. Progress in the synthesis of polycyclic natural products: the total synthesis of lycopodine. G. Stork, *Pure Appl. Chem.* **17**, 383 (1968).
90. A convenient route to *cis* and *trans* trisubstituted olefins from geraniol and nerol. G. Stork, M. Gregson and P. A. Grieco, *Tetrahedron Lett.* 1391 (1969).
91. Synthesis of allylic halides and 1,5-dienes from allylic alcohols. G. Stork, P. A. Grieco and M. Gregson, *Tetrahedron Lett.* 1393 (1969).
92. Six membered rings via olefin participation in the opening of acylcyclopropanes. G. Stork and M. Marx, *J. Am. Chem. Soc.* **91**, 2371 (1969).
93. Aryl participation in concerted cyclization of cyclopropyl ketones. G. Stork and M. Gregson, *J. Am. Chem. Soc.* **91**, 2373 (1969).
94. Olefin participation in the acid-catalyzed opening of acylcyclopropanes (III). Formation of the [2.2.1]bicycloheptane system. G. Stork and P. A. Grieco, *J. Am. Chem. Soc.* **91**, 2407 (1969).
95. A new approach to the stereospecific synthesis of angularly substituted polycyclic systems. G. Stork and P. L. Stotter, *J. Am. Chem. Soc.* **91**, 7780 (1969).
96. A general synthesis of alkyl-pyrrolones and dihydropyridones. G. Stork and R. Matthews, *J. Chem. Soc. Chem. Commun.* 445 (1970).
97. A new synthesis of aldehydes via vinylsilanes. G. Stork and E. Colvin, *J. Am. Chem. Soc.* **93**, 2080 (1971).
98. A versatile synthesis of cyclopentenones. G. Stork, G. Nelson, F. Rouessac and O. Gringore, *J. Am. Chem. Soc.* **93**, 3091 (1971).
99. Olefin participation in the acid-catalyzed opening of acylcyclopropanes IV. Cyclization of 5-methyl-6-endo-(*trans*-3-pentyl) bicyclo[3.1.0]hexan-2-one. G. Stork and P. A. Grieco, *Tetrahedron Lett.* **21**, 1807 (1971).
100. Some developments in annelation methods. G. Stork, *Excerpta Med. Int. Congr. Ser.* No. 219, 101 (1971).
101. The total synthesis of *dl*-camptothecin. G. Stork and A. G. Schultz, *J. Am. Chem. Soc.* **93**, 4074 (1971).
102. A new pyridine synthesis via 4-(3-oxoalkyl)isoxazoles. G. Stork, M. Ohashi, H. Kamachi and H. Kakisawa, *J. Org. Chem.* **36**, 2784 (1971).
103. The total synthesis of lupeol. G. Stork, S. Uyeo, T. Wakamatsu, P. A. Grieco and J. Labovitz, *J. Am. Chem. Soc.* **93**, 4945 (1971).
104. Anions of protected cyanohydrins as acyl carbanion equivalents and their use in a new synthesis of ketones. G. Stork and L. Maldonado, *J. Am. Chem. Soc.* **93**, 5286 (1971).
105. Monoalkylation of  $\alpha,\beta$ -unsaturated ketones via metalloenamines. G. Stork and J. Benaim, *J. Am. Chem. Soc.* **93**, 5938 (1971).
106. The total synthesis of the pentacyclic triterpene lupeol. G. Stork, *XXIIIrd International Congress of Pure & Applied Chemistry, Special Lectures*, Vol. 2, p. 193. Butterworths, London (1971).
107. The total synthesis of ( $\pm$ )-byssochlamic acid. G. Stork, J. M. Tabak and J. F. Blount, *J. Am. Chem. Soc.* **94**, 4735 (1972).
108. Stereoselective total syntheses of ( $\pm$ )-yohimbine, ( $\pm$ )- $\psi$ -yohimbine, and ( $\pm$ )- $\beta$ -yohimbine. G. Stork and R. N. Guthikonda, *J. Am. Chem. Soc.* **94**, 5109 (1972).
109. A general synthesis of esters of acryloylacetic acid and their homologs, G. Stork and R. N. Guthikonda, *Tetrahedron Lett.* 2755 (1972).
110. Haloketal cyclization. A general method for the synthesis of functionalized *cis* bicyclic ketones. G. Stork, J. O. Gardner, R. K. Boeckmann, Jr. and K. A. Parker, *J. Am. Chem. Soc.* **95**, 2014 (1973).
111. Mechanism and stereochemical control in the  $\alpha$ -haloketal cyclization. A remarkable effect of metal cations. G. Stork and R. K. Boeckmann, Jr., *J. Am. Chem. Soc.* **95**, 2016 (1973).
112. The regiospecific alkylation of cyclic  $\alpha$ -diketone enol ethers. A general synthesis of 4-alkylcyclohexenones. G. Stork and R. L. Danheiser, *J. Org. Chem.* **38**, 1775 (1973).
113. Spiroannelation of enol ethers of cyclic  $\beta$ -diketones. A simple stereospecific synthesis of  $\beta$ -vetivone. G. Stork, R. L. Danheiser and B. Ganem, *J. Am. Chem. Soc.* **95**, 3414 (1973).
114.  $\alpha$ -Silylated vinyl ketones. A new class of reagents for the annelation of ketones. G. Stork and B. Ganem, *J. Am. Chem. Soc.* **95**, 6152 (1973).
115. New organic synthetic methods. G. Stork, XXIIIrd Organic Chemistry Symposium of American Chemical Society, Tallahassee, Florida, June (1973).
116. Vinylsilanes as carbonyl precursors. G. Stork and M. Jung, *J. Am. Chem. Soc.* **96**, 3682 (1974).
117. Synthetic routes to halomethyl vinylsilanes. G. Stork, M. Jung, E. Colvin and Y. Noel, *J. Am. Chem. Soc.* **96**, 3684 (1974).
118. Epoxynitrile cyclization. A general method of ring formation. G. Stork, L. D. Cama and D. R. Coulson, *J. Am. Chem. Soc.* **96**, 5268 (1974).
119. Ring size in epoxynitrile cyclization. A general synthesis of functionally substituted cyclobutanes. Application to ( $\pm$ ) grandisol. G. Stork and J. F. Cohen, *J. Am. Chem. Soc.* **96**, 5270 (1974).
120. Conjugate addition of acyl carbanion equivalents via the protected cyanohydrin method. G. Stork and L. Maldonado, *J. Am. Chem. Soc.* **96**, 5272 (1974).
121. Carboxy- $\beta$ -lactams by photochemical ring contraction. G. Stork and R. P. Szajewski, *J. Am. Chem. Soc.* **96**, 5787 (1974).
122. Regiospecific Michael reactions in aprotic solvents with  $\alpha$ -silylated electrophilic olefins. Application to annelation reactions. G. Stork and J. Singh, *J. Am. Chem. Soc.* **96**, 6181 (1974).
123. Highly stereoselective total syntheses of prostaglandins via stereospecific sulfenate-sulfoxide transformations. 13-*cis*-15 $\beta$ -Prostaglandins E<sub>1</sub> to prostaglandins E<sub>1</sub>. G. Stork, J. G. Miller, W. Kurz and K. G. Untch, *J. Am. Chem. Soc.* **96**, 6774 (1974).

## Publications

124. Condensation of formaldehyde with regioselectively generated anions. G. Stork and J. D'Angelo, *J. Am. Chem. Soc.* **96**, 7114 (1974).
125. Regioselective aldol condensations of the kinetic lithium enolates of methyl ketones. G. Stork, G. Kraus and G. Garcia, *J. Org. Chem.* **39**, 3459 (1974).
126. Synthesis of small rings via the protected cyanohydrin method. G. Stork, J. Depezay and J. D'Angelo, *Tetrahedron Lett.* 389 (1975).
127. A synthesis of *dl*-muscone from cyclododecanone. G. Stork and T. L. Macdonald, *J. Am. Chem. Soc.* **97**, 1264 (1975).
128. A route to prostaglandins via a general synthesis of 4-hydroxycyclopentenones. G. Stork, C. Kowalski and G. Garcia, *J. Am. Chem. Soc.* **97**, 3258 (1975).
129. A general approach to prostaglandins via methylenecyclopentanones. Total synthesis of ( $\pm$ )-prostaglandin F<sub>2 $\alpha$</sub> . G. Stork and M. Isobe, *J. Am. Chem. Soc.* **97**, 4745 (1975).
130. The use of kinetically generated unstable enolate ions in the regioselective formation of carbon-carbon bonds. Special applications to annelation processes. G. Stork, *Pure Appl. Chem.* **43**, 553 (1975).
131. A simple total synthesis of prostaglandins from 4-cumyloxy-2-cyclopentenone. G. Stork and M. Isobe, *J. Am. Chem. Soc.* **97**, 6260 (1975).
132. Total synthesis of prostaglandins F<sub>2 $\alpha$</sub> . G. Stork and M. Isobe, XIXth Symposium on the Chemistry of Natural Products, Hiroshima, Japan, October (1975).
133. Chiral synthesis of prostaglandins from carbohydrates. Synthesis of (+)-15-( $\Delta$ )-prostaglandin A<sub>2</sub>. G. Stork and S. Raucher, *J. Am. Chem. Soc.* **98**, 1583 (1976).
134. A new synthesis of vinylogous aldols and polyenones. G. Stork and G. Kraus, *J. Am. Chem. Soc.* **98**, 2351 (1976).
135.  $\alpha$ -Alkylation and arylation of  $\alpha,\beta$ -unsaturated ketones. G. Stork and A. A. Ponnaras, *J. Org. Chem.* **41**, 2937 (1976).
136. Alkylation and Michael additions of glycine ethyl ester. Use in  $\alpha$ -amino acid synthesis and as carbanion equivalent. G. Stork, A. Leong and A.-M. Touzin, *J. Org. Chem.* **41**, 3491 (1976).
137. The ene reaction as a route to 3-hydroxycyclopentanone derivatives. Application to the prostaglandins. G. Stork and G. Kraus, *J. Am. Chem. Soc.* **98**, 6747 (1976).
138. Chiral synthesis of prostaglandins (PGE<sub>1</sub>) from *D*-glyceraldehyde. G. Stork and T. Takahashi, *J. Am. Chem. Soc.* **99**, 1275 (1977).
139. Concerning the stereochemistry of the S<sub>N</sub>2' reaction in cyclohexenyl systems. G. Stork and A. F. Kreft, III, *J. Am. Chem. Soc.* **99**, 3850 (1977).
140. Concerning the stereochemistry of the S<sub>N</sub>2' reaction. "Concerted" allylic displacement in an acyclic system: anti displacement with thiolate anion. G. Stork and A. F. Kreft, III, *J. Am. Chem. Soc.* **99**, 3851 (1977).
141. Five- and six-membered ring formation from olefinic  $\alpha,\beta$ -epoxy ketones and hydrazine. G. Stork and P. Williard, *J. Am. Chem. Soc.* **99**, 7067 (1977).
142. The intramolecular Michael addition as a route to angularly substituted *cis*-hydrindanes. G. Stork, D. F. Taber and M. Marx, *Tetrahedron Lett.* 2445 (1978).
143. 3-Benzoyloxyisoxazole system in construction of tetracyclines. G. Stork and A. A. Hagedorn, III, *J. Am. Chem. Soc.* **100**, 3609 (1978).
144. The total synthesis of cytochalasin B. G. Stork, Y. Nakahara, Y. Nakahara and W. J. Greenlee, *J. Am. Chem. Soc.* **100**, 7775 (1978).
145. *N,N*-Diethylaminoacetonitrile. A generally useful latent acyl carbanion. G. Stork; A. A. Ozorio and A. Y. W. Leong, *Tetrahedron Lett.* 5175 (1978).
146. Total synthesis of prostaglandin F<sub>2 $\alpha$</sub>  by chirality transfer from *D*-glucose. G. Stork, T. Takahashi, I. Kawamoto and T. Suzuki, *J. Am. Chem. Soc.* **100**, 8272 (1978).
147. The role of steroids in the development of synthetic methods. G. Stork, Prix Roussel Award Address, Paris, France, 8 June (1978).
148. Substitution at the  $\alpha$ -position of amines. Alpha cyanoamines as latent alpha aminocarbanions. G. Stork, R. M. Jacobson and R. Levitz, *Tetrahedron Lett.* 771 (1979).
149. A stereoselective synthesis of the ( $\pm$ ) Djerassi-Prelog lactonic acid. G. Stork and V. Nair, *J. Am. Chem. Soc.* **101**, 1315 (1979).
150. Concerted intramolecular displacement with rearrangement in allylic systems. Displacement of an allylic ester with a carbanion. G. Stork and A. R. Schoofs, *J. Am. Chem. Soc.* **101**, 5081 (1979).
151. An intramolecular Diels-Alder approach to the galanthan ring system. D. J. Morgans and G. Stork, *Tetrahedron Lett.* 1959 (1979).
152. Routes to bicyclo[x.3.0.] ring systems: stereoselective syntheses of *cis*- and of *trans*-8-methylhydrindans. P. R. Bernstein and G. Stork, *Tetrahedron Lett.* 1967 (1979).
153. Organocuprate reaction of enone lactones. I. Synthesis of *trans*-fused rings via conjugate addition. G. Stork and E. W. Logusch, *Tetrahedron Lett.* 3361 (1979).
154. Large ring lactones by internal ketophosphonate cyclizations. G. Stork and E. Nakamura, *J. Org. Chem.* **44**, 4010 (1979).
155. Reductive cyclization of ethynyl ketones in the construction of a significant tricyclic intermediate for the synthesis of gibberellic acid. G. Stork, R. Boeckmann, D. Taber, W. C. Still and J. Singh, *J. Am. Chem. Soc.* **101**, 7107 (1979).
156. An unusually simple construction of ring A of gibberellic acid. G. Stork and J. Singh, *J. Am. Chem. Soc.* **101**, 7109 (1979).
157. A simple stereoselective synthesis of the skeleton of the lycorine alkaloids. G. Stork and D. J. Morgans, *J. Am. Chem. Soc.* **101**, 7110 (1979).
158. Unusual regioselectivity in the enolization of a ketone as the result of difference in energy to achieve the best overlap of an alpha hydrogen. G. Stork, W. C. Still and J. Singh, *Tetrahedron Lett.* 5077 (1979).
159. Reductive alkylation of enediones. 1. G. Stork and E. W. Logusch, *J. Am. Chem. Soc.* **102**, 1218 (1980).
160. Reductive alkylation of enediones. 2. Synthesis of corticosteroids. G. Stork and E. W. Logusch, *J. Am. Chem. Soc.* **102**, 1219 (1980).
161. Elaboration of a tricyclic gibberellic acid intermediate. G. Stork, W. C. Still, J. Singh and S. Takei, *Tetrahedron Lett.* 4051 (1980).

162. A new route to 11-oxygenated steroids. G. Stork, G. Clark and C. S. Shiner, *J. Am. Chem. Soc.* **103**, 4948 (1981).
163. The cyclization of vinyl radicals: a versatile method for the construction of five- and six-membered rings. G. Stork and N. H. Baine, *J. Am. Chem. Soc.* **104**, 2321 (1982).
164. Stereochemical control of the internal Michael reaction. A new construction of trans-hydrindane systems. G. Stork, C. S. Shiner and J. D. Winkler, *J. Am. Chem. Soc.* **104**, 310 (1982).
165. Stereochemical control of intramolecular conjugate addition. A short, highly stereoselective synthesis of adrenosterone. G. Stork, J. D. Winkler and C. S. Shiner, *J. Am. Chem. Soc.* **104**, 3767 (1982).
166. An efficient *de novo* construction of the indanepropionic acid precursor of 11-ketosteroids. An improved internal Diels-Alder sequence. G. Stork and D. H. Sherman, *J. Am. Chem. Soc.* **104**, 3758 (1982).
167. A stereoselective synthesis of the chiral sequence of erythronolide. A. G. Stork, I. Paterson and F. K. C. Lee, *J. Am. Chem. Soc.* **104**, 4686 (1982).
168. An isomerization-Claisen rearrangement route to olefinic dicarbonyl starting materials for conjugate cyclization, G. Stork and K. S. Atwal, *Tetrahedron Lett.* **24**, 2073 (1982).
169. Vinyl and beta-alkoxy radicals in organic synthesis. G. Stork, in *Current Trends in Organic Synthesis* (Edited by H. Nozaki), pp. 359-371. New York (1983).
170. Stereoselective synthesis of *cis*- and *trans*-4-carboxy-3a,4,5,6-tetrahydroindan-1-ones. J. Ficini, A. Guingant, J. D'Angelo and G. Stork, *Tetrahedron Lett.* **24**, 907 (1983).
171. Stereochemical control in the construction of vicinally substituted cyclopentanes and cyclohexanes. Intramolecular conjugate addition of  $\beta$ -ketoester anions. G. Stork, J. D. Winkler and N. Saccomano, *Tetrahedron Lett.* **24**, 465 (1983).
172. 2-Substituted tetrahydrofurans of known absolute stereochemistry by ScN' chirality transfer. G. Stork and J. M. Poirier, *J. Am. Chem. Soc.* **105**, 1073 (1983).
173. Stereocontrol in homogeneous catalytic hydrogenation via hydroxyl group coordination. G. Stork and D. E. Kahne, *J. Am. Chem. Soc.* **105**, 1072 (1983).
174. Vinyl radical cyclization II. Dicyclization via selective formation of unsaturated vinyl radicals by intramolecular addition to triple bonds. Application to the synthesis of butenolides. G. Stork and R. Mook, Jr., *J. Am. Chem. Soc.* **105**, 3720 (1983).
175. Free radical cyclization of bromoacetals. Use in the construction of bicyclic acetals and lactones. G. Stork, R. Mook, Jr., S. A. Biller and S. D. Rychnovsky, *J. Am. Chem. Soc.* **105**, 3741 (1983).
176. A simplified total synthesis of cytochalasins via an intramolecular Diels-Alder reaction. G. Stork and E. Nakamura, *J. Am. Chem. Soc.* **105**, 5510 (1983).
177. A highly stereoselective osmium tetroxide-catalyzed hydroxylation of  $\gamma$ -hydroxy  $\alpha,\beta$ -unsaturated esters. G. Stork and M. Kahn, *Tetrahedron Lett.* **24**, 3951 (1983).
178. Regiospecific trapping of radicals from cyclization reactions. Cyclic nitriles via isocyanide trapping. G. Stork and P. M. Sher, *J. Am. Chem. Soc.* **105**, 6765 (1983).
179. Highly stereoselective axial addition of ethynyl carbanions to the carbonyl of cyclohexenones. G. Stork and J. M. Stryker, *Tetrahedron Lett.* **24**, 4887 (1983).
180. Radical-mediated cyclization processes. G. Stork, in *Selectivity — a Goal for Synthetic Efficiency* (Edited by W. Bartman and M. M. Trost), pp. 281-299. Verlag Chemie, Basel (1984).
181. X-Ray crystal structure of N-(2-lithiocyclohexenyl)-N,N',N'-trimethyl-1,3-propanediamine. G. B. Carpenter, P. Williard, G. Stork and R. L. Polt, *J. Am. Chem. Soc.* **106**, 4276 (1984).
182. A construction of the angularly hydroxylated *cis*-1,8-naphthalenedione system typical of the tetracyclines. G. Stork and Y. K. Yee, *Can. J. Chem.* **62**, 2627 (1984).
183. Simple preparation of a useful C/D-ring fragment for the construction of 11-keto steroids. G. Stork, G. Clark and T. Weller, *Tetrahedron Lett.* **25**, 5367 (1984).
184. Control of ring junction stereochemistry via radical cyclization. G. Stork and M. Kahn, *J. Am. Chem. Soc.* **107**, 500 (1985).
185. The deprotonation of chelating enamines. Direct formation of  $\beta$ -lithioenamines. G. Stork, C. S. Shiner, C.-W. Cheng and R. L. Polt, *J. Am. Chem. Soc.* (submitted).