

REFERENCES

1. *Carbohydrates as Organic Raw Materials*; Lichtenthaler, F.W., Ed.; VCH Publishers: **Weinheim/New York**, 1991.
2. a) *Bioactive Carbohydrates in Chemistry, Biochemistry and Biology*; **Kennedy, J. F.**; White, C. A.; Halsted Press: New York, 1983. b) Kennedy, J. F. *Carbohydrate Chemistry*; Clarendon Press, Oxford, 1988.
3. a) Lowe, J. B. Red cell membrane antigens, *The molecular Basis of Blood Diseases*; Stanatoyannopoulos, **etal.**, Eds.; W. B. Saunders Company: Philadelphia, P. A., 1994, p293. b) Ichikawa, Y.; **Halcomb, R. L.**; Wong, C - H. *Chem. Britain* 1994, 117.
4. *Sialic Acids, Chemistry, Metabolism and Function*; Schauer, R.; Ed.; **Springer-Verlag**: Wien, 1982.
5. **Hakamori, S.** *Ann. Rev. Biochem.* 1981, 50, 733.
6. a) Hauser, F. **M.**; Ellenberger, S. *Chem. Rev.* 1986, 86, 35. b) Halcomb, R. L.; Boyer, S. H.; Danishefsky, S. J. *Angew. Chem. Int. Ed. Engl.* 1992, 31, 338. c) *Recent Progress in the Chemical Synthesis of Antibiotics*; Lukacs, G.; Ohno, M.; Eds.; **Springer-Verlag**, Berlin-Heidelberg, 1990.
7. Meyers, A. G. *Tetrahedron lett.* 1987, 28, 4493. b) **Zeing, N.**; Sinha, A. M.; McGahren, W. J.; **Ellestad, G. A.** *Science* 1988, 240, 1198.
8. a) Fischer, E. *Ber. Dtsch. Chem. Ges.* 1891, 24, 1836 and 2683. b) Lichtenthaler, F. W. *Angew. Chem. Int. Ed. Engl.* 1992, 31, 1541. c) **Kauffman, G. B.**; **Ciula, R. P.** *J. Chem. Educ.* 1977, 54, 295.
9. a) Hanessian, S. *Total Synthesis of Natural Products: the "Chiron" Approach*; **Pergamon**: Oxford, 1983. b) Lichtenthaler, F. W. *Modern Synthetic Methods, 1992* **Scheffold, R.** Ed.; VCH: New **York**, p.273. c) Abel, S.; Faber, D.; Huter, **O.**; Giese, B. *Angew. Chem. Int. Ed. Engl.* 1994, 33, 2466.
10. a) Schmidt, R. R. *Pure & Appl. Chem.* 1989, 61, 1257. b) Schmidt, R.R. *Comprehensive Organic Synthesis*; Pergamon Press: **Oxford**, 1991, Vol.(5, p.33. c) Sinay, P. *Pure & Appl. Chem.* 1991, 63, 519. d) Schmidt, R.R.

- Carbohydrates, Synthetic Methods and Applications in Medicinal Chemistry*; Kodansha: Tokyo, 1992, p.66. e) **Toshima, K.**; **Tatsuta, K.** *Chem. Rev.* 1993, 93, 1503. f) Boons, G. J. *Tetrahedron* 1996, 52, 1095.
11. a) **Ko, S.Y.**; Lee, A. W. M.; **Masamune, S.**; **Reed, III, L. A.**; Sharpless, K. B.; Walker, F. J. *Tetrahedron* 1990, 46, 245. b) Masamune, S.; Chay, W.; **Petersen, J. S.**; **Sita, L. R.** *Angew. Chem. Int. Ed. Engl.* 1985, 24, 1. c) **Minami, N.**; Ko, S. S.; Rishi, Y. *J. Am. Chem. Soc.* **1982, 104, 1109.**
 12. Danishefsky, S. J.; DeNinno, MP. *Angew. Chem. Int. Ed. Engl.* 1987, 26, 15.
 13. Wong, C.-H.; **Halcomb, R. L.**; **Ichikawa, Y.**; **Kajimoto, T.** *Angew. Chem. Int. Ed. Engl.* 1994, 34, 412 and 521.
 14. **Ferrier, R. J.**; **Middleton, S.** *Chem. Rev.* 1993, 93, 2779.
 15. a) Fischer, E.; Zach. **K. Sitzber. kgl. preuss. Akad. Wiss.**, 1913, 16, 311. b) Helferich, B ; Mulcahy, E. W ; Ziegler, H. *Chem. Ber.* 1954, 87, 233.
 16. Cavallaro, C. L.; Schwartz, J. J. *J. Org. Chem.* 1995, 60, 7055 and references cited therein.
 17. Lancelin, J.-M.; **Morin-Allory, L.**; Sinay, P. *J. Chem. Soc. Chem. Commun.* 1984, 355
 18. Feast, A. A.; Overend, W. **G.**; Williams, N. R. *J. Chem. Soc.* 1965, 7378
 19. Kudelska, W.; Michalska, M. *Tetrahedron* 1981, 37, 2989.
 20. Patroni, J. J.; Stick, R. V.; Tilbrook, D. M. G.; Sketton, B. W.; White, A. H. *Aust. J. Chem.* 1989, 42, 2127.
 21. Gomez, A. M.; Casillas, M.; Valverde, S.; Lopez, J. C. *J. Chem. Soc. Chem. Commun.* 1996, 2357.
 22. Hacksell, U; Daves, G. D., Jr. *Prog. Med. Chem.* 1985, 22, 1.
 23. a) **Jaramillo, C.**; Knapp, S. *Synthesis* 1994, 1. b) Daves, G. D. Jr. *Acc. Chem. Res.* 1990,23,201.
 24. a) Dubois, E.; Beau, J.-M. *Tetrahedron Lett.* 1990, 31, 5165. b) Dubois, E.; Beau, **J.-M.** *J. Chem. Soc. Chem. Commun.* 1990, 1191.

25. Boyd, V. A.; Drake, B. E.; Sulikowski, G. A. *J. Org. Chem.* 1993, 58, 3191.
26. a) **Ramesh**, N. G.; **Balasubramanian**, K. K. *Tetrahedron Lett.* **1991**, 32, 3875.
b) **Booma**, C; Balasubramanian, K. K. *J. Chem. Soc. Chem. Commun.* **1993**, **1394**. c) Ramesh, N. G.; Balasubramanian, K. K. *Tetrahedron* **1995**, 51, 255.
27. a) **Lemieux**, R. U.; Levine, S. *Can. J. Chem.* 1964, 42, 1473. b) **Lemieux**, R. U.; Morgan, A. R. *Can. J. Chem.* 1965, 43, 2190. c) Lemieux, R. U.; Fraser* Reid, B. *Can. J. Chem.* 1965, 43, 1460.
28. a) **Thiem**, J; Karl, H; **Schwentner**, J. *Synthesis* 1978, 696. b) **Thiem**, J; Karl, H. *Tetrahedron Lett.* 1978, 4999.
29. a) Friesen, R. W.; Danishefsky, S. J. *J. Am. Chem. Soc.* 1989, 111, 6656. b) Danishefsky, S. J.; **Armistead**, D. M; **Wincott**, F. E.; **Selnick**, H. G.; **Hungate**, R. *J. Am. Chem. Soc.* 1989, 111, 2967. c) Friesen, R. W.; Danishefsky, S. J. *Tetrahedron* 1990, 46, 103. c) Suzuki, K; Sulikowski, G. A., **Friesen**, R. W.; Danishefsky, S. J. *J. Am. Chem. Soc.* **1990**, 112, 8895.
30. **Tatsuta**, K.; **Fujimoto**, K; **Kinoshita**, M.; **Umezawa**, S. *Carbohydr. Res.* 1977, 54, 85.
31. Danishefsky, S. J.; **Selnick**, H. G.; **Armistead**, D. M.; **Wincott**, F. E. *J. Am. Chem. Soc.* **1987**, 109, 8199.
32. a) **Tatsuta**, K.; **Tanaka**, A.; **Fujimoto**, K; **Kinoshita**, M.; **Umezawa**, S. *J. Am. Chem. Soc.* 1977, 99, 5826. b) **Tatsuta**, K; **Amemiya**, Y.; **Maniwa**, S.; **Kinoshita**, M. *Tetrahedron Lett.* 1980, 21, 2837. c) **Tatsuta**, K; **Yamamuchi**, T.; **Kinoshita**, M. *Bull. Chem. Soc. Jpn.* **1978**, 51, 3035.
33. Lemieux, R. U.; **Nagabhushana**, T. L. *Can. J. Chem.* **1968**, 46, 401.
34. **Czernecki**, S.; **Ayadi**, E.; **Randriamandimby**, D. *J. Chem. Soc. Chem. Commun.* **1994**, 35.
35. **Giuliano**, R. M.; **Davis**, R. S.; **Boyko**, W. J. *J. Carbohydr. Chem.* **1994**, 13, 1135.
36. **Dax**, K.; **Glanzer**, B. I. *Carbohydr. Res.* **1987**, 162, 13.

37. Ito, Y.; Ogawa, T. *Tetrahedron Lett.* **1987**, 28, 2723.
38. Grewal, G.; Kaila, N.; Franck, R. W. *J. Org. Chem.* 1992, 57, 2084.
39. Lemieux, R. U.; Ratcliffe, R. M. *Can. J. Chem.* **1979**, 57, 1244.
40. Gonzalez, F.S.; Flores, F.G.-C; García, J.-C; Mateo, F. H.; Mendoza, P. G.; Diaz, R. R *Tetrahedron* **1994**, 50, 2877.
41. a) Kessler, H.; Kling, A.; Kottenbahn, M. *Angew. Chem. Int. Ed. Engl.* **1990**, 29, 425. b) Kessler, H.; Kottenbahn, M; Kling, A.; Kolar, C. *Angew. Chem. Int. Ed. Engl* **1987**, 26, 888.
42. a) Lee, D. H.; Kim, J. Y.; Kim, Y. H. *Arch Pharmacol. Res.* **1994**, 17, 207. b) Diaz, Y.; El.langhdach, A.; Matheu, M. I.; Castillon, S. *J. Org. Chem.* **1997**, 62, 1501.
43. Sharma, G. V. M.; Krishnu, K. *Carbohydr. Res.* 1995, 268, 287.
44. Jaouen, V.; Jegou, A.; Veyrieres, A. *Synlett* 1996, 1218.
45. a) Wakamatsu, T.; Nakamura, H.; Naka, E.; Ban, Y. *Tetrahedron Lett.* **1986**, 27, 3895. b) Toshima, K.; Tatsuta, K.; Kinoshita, M. *Bull. Chem. Soc. Jpn.* **1988**, 61, 2369.
46. Tu, C. J.; Lednicer, D. *J. Org. Chem.* **1987**, 52, 5624.
47. Bolitt, V.; Mioskowski, C ; Lee, S.-G.; Falck, J. R. *J. Org. Chem.* **1990**, 55, 5812.
48. Sabesan, S.; Neira, S. *J. Org. Chem.* **1991**, 56, 5468.
49. Tatsuta, K.; Kobayashi, Y.; Gunji, H.; Masuda, H. *Tetrahedron Lett.* **1988**, 29, 3975.
50. Holzapfel, C. W.; Engelbrecht, G. J.; Verdoon, G. H. *Heterocycles* **1989**, 28, 433.
51. a) Inglis, G. R.; Schwarz, J. C. P.; McLaren, L. *J. Chem. Soc.* **1962**, 1014. b) Manolopoulos, P. T.; Mednick, M.; Lichtin, N. N. *J. Am. Chem. Soc.* **1962**, 84, 2203.
52. Giese, B ; Groninger, R. *Tetrahedron Lett.* 1984, 25, 2743.

53. **Leftin**, J. H.; Lichtin, N. N. *Israeli Chem.* 1965, 5, 107.
54. Gonzales, F.; **Lesage**, S.; Perlin, A. S. *Carbohydr. Res.* 1975, 42, 267.
55. Lichtenthaler, F. W.; Ronninger, S.; Jarglis, P. *Liebigs Ann. Chem.* 1989, 1153.
56. Hilles, S.; Niklaus, A.; Reiser, O. *J. Org. Chem.* 1993, 58, 3169.
57. Kaye, A.; **Neidle**, S.; Reese, C. B. *Tetrahedron Lett.* 1988, 29, 1841.
58. a) Ferrier, R. J.; Prasad, N.; Sankey, G. H. *J. Chem. Soc. (C)* 1968, 974. b) Ferrier, R. J.; Prasad, N. *J. Chem. Soc. (C)* 1969, 570. c) Paulsen, H.; **Thiem**, J. *Chem. Ber.* 1973, 106, 3850. d) Guthrie, R. D.; Irvine, R. W. *Carbohydr. Res.* 1980, 82, 207.
59. a) **Toshima**, K.; Ishizuka, T.; Matsuo, G.; Nakata, M. *Synlett* 1995, 306. b) **Toshima**, K.; Miyamoto, N.; Matsuo, G.; Nakata, M.; **Matsumura**, S. *J. Chem. Soc. Chem. Commun.* 1996, 1379.
60. **Taillefumier**, C; Chapleur, Y.; Bayeul, D.; Aubry, A. *J. Chem. Soc. Chem. Commun.* 1995, 937.
61. **Klaic**, B.; Raza, Z.; Sankovic, M.; Sunjic, V. *Helv. Chim. Acta* 1987, 70, 59.
62. **Inaba**, K.; **Mastumura**, S.; Yoshikawa, S. *Chem. Lett.* 1991, 485.
63. Thorn, S. N.; Gallagher, T. *Synlett* 1996, 856.
64. Sobti, A.; Sulikowski, G. A. *Tetrahedron Lett.* 1994, 55, 3661.
65. Gupta, R. B.; Frank, R. W. *J. Am. Chem. Soc.* 1989, 111, 7668.
66. Capozzi, G.; Falciani, C; Menichetti, S.; Nativi, C; **Franck**, R. W. *Tetrahedron Lett.* 1995, 36, 6755.
67. Fredrickson, M. *Tetrahedron* 1997, 53, 403.
68. **Hewson**, A. T.; Jeferry, J.; Szczur, N. *Tetrahedron Lett.* 1995, 36, 7731.
69. Armstrong, P. L.; **Coull**, I. C; Hewson, A. T.; Slater, M. *Tetrahedron Lett.* 1995, 36, 4311.

70. a) Tadano, K. In *Studies in Natural Products Chemistry*; **Atta-Ur-Rahman**; Ed.; Elsevier Science Publishers B.V.: 1992, *10*, 405. b) **Rolin**, P.; Sinay, P. *Carbohydr. Res.* **1981**, *98*, 139.
71. **Bertrand**, P.; Geson, J.-P.; **Renoux**, B.; Tranoy, I. *Tetrahedron Lett.* 1995, *36*, 4073.
72. a) Redlich, H.; Lenfers, J. B.; Kopf, J. *Angew. Chem. Int. Ed. Engl.* 1989, *28*, 777. b) Oh, J. *Tetrahedron Lett.* 1997, *38*, 3249.
73. a) **Chmielewski**, M; Kaluza, Z.; Belzeck, C; Salanski, P.; Jurcazk, J.; **Adamowicz**, H. *Tetrahedron* 1985, *41*, 2441. b) **Kaluza**, Z ; **Abramski**, W.; Belzecki, C; Grodner, J.; Mostowicz, D.; Urbanski, R.; Chmielewski, M. *Synlett* 1994, 539. c) Grodner, J.; Chmielewski, M. *Tetrahedron* 1995, *51*, 829.
74. Fischer, E. *Ber. Dtsch. Chem. Ges.* 1891, *24*, 2683.
75. Koenig, W.; Knorr, *Ber. Dtsch. Chem. Ges.* 1901, *34*, 957.
76. a) Schmidt, R. R.; Michel, J. *Angew. Chem. Int. Ed. Engl.* 1980, *19*, 731. b) Schmidt, R. R.; Kinzy, W. *Adv. Carbohydr. Chem.* 1994, *50*, 21.
77. a) Fraser-Reid, B.; Konradsson, P.; Mootoo, D. R.; **Udodong**, U. *J. Chem. Soc. Chem. Commun.* 1988, 823. b) Mootoo, D. R.; Konradsson, P.; Udodong, U.; Fraser-Reid, B. *J. Am. Chem. Soc.* 1988, *110*, 5583. c) Fraser-Reid, B.; Wu, Z.; Udodong, U.; Ottosson, H. *J. Org. Chem.* 1990, *55*, 6068.
78. a) Kunz, H.; Wernig, P.; Schultz, M. *Synlett* 1990, 631. b) Lopez, J. C; Fraser-Reid, **B.** *J. Chem. Soc. Chem. Commun.* **1991**, 159.
79. Nicolaou, K. C; **Dolle**, R. E.; Papahatjis, D. P.; Randall, J. L. *J. Am. Chem. Soc.* **1984**, *106*, 4189.
80. a) Briner, K.; Vasella, A. *Helv. Chim. Acta* 1989, *72*, 1371. b) Vasella, A. *Pure & Appl. Chem.* **1991**, *63*, 507.
81. a) Stork, G.; Kim, G. *J. Am. Chem. Soc.* **1992**, *114*, 1087. b) Stork, G.; **Clair**, **J. J. L.** *J. Am. Chem. Soc.* **1996**, *118*, 247.

82. Spijker, N. M.; van **Boeckel**, C. A. A. *Angew. Chem. Int. Ed. Engl.* 1991, *30*, 180.
83. Danishefsky, S. J.; Roberge, J. Y. *Pure & Appl. Chem.* 1995, *67*, 1647.
84. a) McClure, K.F.; **Randolph**, J.; Ruggeri, R.; Danishefsky, S. J. *Science* 1993, *260*, 1307. b) **Roberge**, J. Y.; **Beebe**, X.; Danishefsky, S. J. *Science* 1995, *269*, 202.
85. **Brigl**, P. *Z Physiol. Chem.* **1922**, *122*, 257.
86. **Halcomb**, R. L.; Danishefsky, S. J. *J. Am. Chem. Soc.* 1989, *111*, 6661.
87. Liu, K. **K.-C.**; Danishefsky, S. J. *J. Org. Chem.* 1994, *59*, 1892.
88. Gervay, J.; Danishefsky, S. J. *J. Org. Chem.* 1991, *56*, 5448.
89. Liu, **K. K.-C.**; Danishefsky, S. J. *J. Org. Chem.* 1994, *59*, 1895.
90. Patch, R. J.; Chen, H.; Pandit, C. R. *J. Org. Chem.* 1997, *62*, 1543.
91. Sanders, W. J.; Kiessling, L. L. *Tetrahedron Lett.* 1994, *35*, 7335.
92. a) **Lafont**, D.; Descotes, G. *Carbohydr. Res.* 1987, *166*, 195. b) Lafont, D.; Descotes, G. *Carbohydr. Res.* **1988**, *175*, 35.
93. a) Griffith, D. A.; Danishefsky, S. J. *J. Am. Chem. Soc.* 1990, *112*, 5811. b) Park, T. K.; Kim, I. J.; Danishefsky, S. J. *Tetrahedron Lett.* 1995, *36*, 9089. c) Kim, I. J.; Park, T. K.; Hu, S.; **Abrampah**, **K.**; Zhang, S.; Livingston, P. O.; Danishefsky, **S. J.** *J. Org. Chem.* 1995, *60*, 7716.
94. Bois, J. D.; **Tomooka**, C. S.; Hong, J.; Carreira, E. M. *J. Am. Chem. Soc.* 1997, *119*, 3179.
95. a) Radatus, B. K.; Fraser-Reid, B. *Can. J. Chem.* 1969, *47*, 4095. b) Radatus, B. K.; **Fraser-Reid**, B. *Can. J. Chem.* 1970, *48*, 2146. c) Radatus, B. K.; Fraser-Reid, B. *Can. J. Chem.* 1972, *50*, 2909. d) Radatus, B. K.; Fraser-Reid, B. *Can. J. Chem.* 1972, *50*, 2919.
96. Duchaussoy, P.; Cesare, P. D.; Gross, B. *Synthesis* 1979, 198.
97. Brimacombe, J. S.; Evans, M. E.; Forbes, E. J.; Foster, A. B.; Webber, J. M. *Carbohydr. Res.* 1967, *4*, 239.

98. **Baidznigitova**, E. A.; Afanasev, V. A.; Dolgii, I. E. *Izvi. Akad. Nauk Kig. SSR* 1981, (J), 50 (CA 95:98188b).
99. **Yasumoto**, T. ; **Murata**, M. *Chem. Rev.* 1993, 93, 1897.
100. Murali, R.; **Ramana**, C. V.; Nagarajan, M. *J. Chem. Soc. Chem. Commun.* 1995, 217.
101. a) Part of this work has been taken from the Ph. D dissertation submitted by Murali, R. 1994, University of Hyderabad, **Hyderabad, India**. b) **Ramana**, C. V.; Murali, R.; Nagarajan, M. *J. Org. Chem.* 1997, 62, 0000.
102. Hoberg, J. O.; Bozell, J. J. *Tetrahedron Lett.* 1995, 36, 6831.
103. Henry Jr., K. J.; Fraser-Reid, B. *Tetrahedron Lett.* 1995, 36, 8901.
104. Timmers, C. M.; Leeuwenburgh, M. A.; Verheijen, J. C; van der **Marel**, G. A.; van **Boom**, J. H. *Tetrahedron: Asymmetry* 1996, 7, 49.
105. Hoberg, J. O.; Claffey, D. J. *Tetrahedron Lett.* 1996, 37, 2533.
106. Scott, R.W.; Heathcock, C. H. *Carbohydr. Res.* 1996, 291, 205.
107. Bertinato, P.; Sorensen, E. J.; Meng, D.; Danishefsky, S. J. *J. Org. Chem.* 1996, 61, 8000.
108. a) Bayer, A. *Chem. Ber.* 1855, 18, 2277. b) **Perkin**, W. H.; *Chem. Ber.* 1884, 17, 54. c) Roder, F. *Ann. Chem.* 1885, 227, 13. d) Fittig, R. *Ann. Chem.* 1885, 227, 25.
109. For recent reviews covering this area see a) Rappoport, Z. *The Chemistry of Cyclopropyl Group* Wiley-Interscience, New York 1987. b) de Meijere, A.; **Wessjohann**, L. *Synlett* 1990, 20. c) Wong, H. N. C. In *Rodds Chemistry of Carbon Compounds Vol II^A/II^C* Chapter 2, Sainsbury, M. Ed.; Elsevier Science Publishers B.V.: Amsterdam, 1992. d) Nair, V. In *Comprehensive Organic Synthesis* Pergamon Press: Oxford, 1991, 4, 999.
110. de Meijere, A. *Angew. Chem. Int. Ed. Engl.* 1979, 18, 809 and references cited therein.

111. a) Newham, J. *Chem. Rev.* 1963, 63, 123. b) Bruchner, C; Reißig, H.-U. *Chem. Ber.* 1987, 120, 627.
112. a) Breslow, R. In *Molecular Rearrangements* de Mayo, P.; Ed.; Interscience: New York, 1963, p.233. b) DePuy, C. H. *Top. Curr. Chem.* 1973, 40, 73. c) Gibson, D. H.; DePuy, C. H. *Chem. Rev.* 1974, 74, 605.
113. a) Skattebøl, L. *J. Org. Chem.* 1970, 35, 3200. b) Groves, J. T.; Ma, R. W. *Tetrahedron left.* 1974, 909. c) Hickmott, P.W. *Tetrahedron* 1984, 40, 2989.
114. a) Moore, W. R.; Bach, R. D. *J. Am. Chem. Soc.* 1972, 94, 3148. b) Christl, M.; Braun, M. *Chem. Ber.* 1989, 122, 1939.
115. a) Wenkert, E. *Acc. Chem. Res.* 1980, 13, 27. b) Trost, B. M. *Acc. Chem. Res.* 1974, 7, 85.
116. a) Ramaiah, M. *Synthesis* 1984, 259. b) Sarel, S. *Acc. Chem. Res.* 1978, 11, 204. c) Corey, E. J.; Myers, A. G. *J. Am. Chem. Soc.* 1985, 107, 5574.
117. a) Wong, H. N. C; Hon, M.-Y.; Tes, C.-W.; Yip, Y.-C; Tanko, J.; Hudlicky, T. *Chem. Rev.* 1989, 89, 165. b) Piers, E. In *Comprehensive Organic Synthesis* Pergamon: Oxford, 1991, 5, 971. c) Lee, J.; Kim, H ; Cha, J. K. *J. Am. Chem. Soc.* 1995, 117, 9919.
118. a) Kawazima, I.; Nakamura, E. *Top. Curr. Chem.* 1990, 155, 1. b) Kawazima, I.; Nakamura, E. In *Comprehensive Organic Synthesis* Pergamon: Oxford, 1991, 2, 441.
119. Reipig, H. U. *Top. Curr. Chem.* 1988, 144, 73.
120. a) Collins, C. J. *Chem. Rev.* 1969, 69, 543. b) Zimmerman, M. P.; Li, H. T.; Duax, W. L.; Weeks, C. M.; Djerassi, C. J. *J. Am. Chem. Soc.* 1984, 106, 5602.
121. Lambert, J. B.; Chelius, E. C; Schulz, W. J., Jr.; Carpenter, N. E. *J. Am. Chem. Soc.* 1990, 112, 3156.
122. a) Lambert, J. B.; Chelius, E. C; Bible, R.Y., Jr.; Hajdu, E. *J. Am. Chem. Soc.* 1991, 113, 1331. b) Coxon, J. M.; Steel, P. J.; Battiste, M. A. *J. Org.*

- Chem* 1989, 54, 3702. c) Coxon, J. M.; Steel, P. J.; Whittington, B. I.; Battiste, M. A. *J. Org. Chem* 1989, 54, 1383. **d) Coxon, J. M.; Steel, P. J.; Whittington, B. I.; Battiste, M. A. *J. Am. Chem. Soc.* 1988, 110, 2988.**
123. Buritt, A.; Coxon, J. M.; Steel, P. J. *J. Org. Chem.* 1995, 60, 7670.
124. Wiberg, K. B.; Kass, S. R. *J. Am. Chem. Soc.* **1985, 107, 988.**
125. Kocovsky, P.; Grech, J. M.; Mitchell, W. *J. Org. Chem.* 1995, 60, 1482 and references cited therein.
126. Cossy, J.; Furet, N. *Tetrahedron Lett.* 1995, 36, 3691.
127. a) Bundle, D. R.; Lemieux, R. U. *Methods Carbohydr. Chem.*, 1976, 7, 79.
b) Hall, L. D. In *The Carbohydrates: Chemistry and Biochemistry*; vol.IB, 2nd edn., Pigman, W.; Horton, D.; Eds.; Academic Press: New York, 1980, p. 1299. c) Coxon, B. *Adv. Carbohydr. Chem. Biochem.* **1972, 27, 7.**
128. a) Bock, K.; Pedersen, C. *Adv. Carbohydr. Chem. Biochem.* 1983, 41, 27.
b) Haverkamp, J.; van Dongen, J. P. C. M.; Vliegthart, J. F. **G. *Tetrahedron* 1973, 29, 3431.**
129. Hudson, C. S. *J. Am. Chem. Soc.* 1909, 31, 66.
130. a) Evans, R. D.; Magee, J. W.; Schauble, J. H. *Synthesis* 1988, 862.
b) Simonot, B.; Rosseau, G. *J. Org. Chem.* 1993, 58, 4. c) Simonot, B.; Rosseau, G. *Tetrahedron lett.* 1993, 34, 4527. c) Simonot, B.; Rosseau, G. *J. Org. Chem.* 1994, 59, 5919. e) Brunei, Y.; Rosseau, G. *Synlett* 1995, 323.
- 131. a) Richtmyer, N. K. *Methods Carbohydr. Chem.* 1962, 1, 107. b) Hanessian, S.; Rancourt, G. *Can. J. Chem.* 1977, 55, 1111. c) Faghieh, R. J. *J. Carbohydr Chem.* 1987, 6, 619.**
132. a) Yunker, M. B.; Plaumann, D.-E.; Fraser-Reid, B. *Can. J. Chem.* 1977, 55, 4002. b) Fraser-Reid, B.; Anderson, R. C ; Hicks, D. R.; Walker, D. L. *Can. J. Chem.* 1977, 55, 3986.
133. Miljkovic, M.; Glišić, B. *J. Org. Chem.* 1975, 40, 3357.
134. Collum, D.B; Still, W.C; Mohamadi, F. *J. Am. Chem. Soc.* 1986, 108, 2094.

135. Barrett, A. G. M; Tarn, W. *J. Org. Chem.* 1997, 62, 4653.
136. a) Hanna, J. G.; Siggia, S. *Anal. Chem.* 1965, 37, 690. b) de la Mare, P. B. D.; Bolton, R. *Electrophilic Additions to Unsaturated Systems*; 2nd edn., Elsevier: Amsterdam, 1981.
137. Dubois, J.E.; Garnier, F. *J. Chem. Soc. Chem. Commun.* 1968, 241.
138. *Organic Solvents*, Techniques of Chemistry, Vol II, Riddick, J. A.; Bunger, W. B.; Wiley-Interscience: New York, 1970.
139. Haszeldine, R. N. *J. Chem. Soc.* 1953, 1757.
140. Esswein, A.; Rembold, H.; Schmidt, R. R. *Carbohydr. Res.* 1990, 200, 287.
141. Bessodes, M; Komiotis, D.; Antonakis, K. *Tetrahedron Lett.* 1986, 27, 579.
142. Friedrich, E. C ; Lewis, E. J. *J. Org. Chem.* 1990, 55, 6892.
143. a) Inghardt, T.; Frejd, T. *Synthesis* 1990, 285. b) Jespersen, T. M.; Bols, M.; Sierks, M. R.; Skrydstrup, T. *Tetrahedron* 1994, 50, 13449.
144. a) Herradon, B.; Fenude, E.; Bao, R.; Vaverde, S. *J. Org. Chem.* 1996, 61, 1143. b) Csuk, R.; Schaade, M.; Krieger, C. *Tetrahedron* 1996, 52, 6397. c) Lopez, J. C; Gomez, A. M; Fraser-Reid, B. *J. Chem. Soc. Chem. Commun.*, 1994, 1533. d) Hsia, K. Y.; Ward, P.; Lamont, R. B.; de Q. Lilley, P. M.; Watkin, D. J.; Fleet, G. W. J. *Tetrahedron Lett.* 1994, 35, 4823.
145. Wantabe, M.; Yoshikoshi, A. *J. Chem. Soc. Perkin Trans. I* 1987, 2833.
146. a) Tius, M. A. *Chem. Rev.* 1988, 88, 719. b) Kametani, T.; Tsubuki, M.; Hondo, T. *Heterocycles* 1989, 28, 59.
147. a) Ksander, G. M; McMurry, J. E. Johnson, M. *J. Org. Chem.* 1977, 42, 2065. b) McMurry, J. E.; Dushin, R. G. *J. Am. Chem. Soc.* 1990, 112, 6942. c) Nishitani, K.; Harada, Y.; Nakamura, Y.; Yokoo, K.; Yamakawa, K. *Tetrahedron Lett.* 1994, 35, 7809. d) Solladie, G.; Boeffel, D.; Maignan, J. *Tetrahedron* 1996, 52, 2065.

148. a) Schmidt, R. R.; Kast, J. *Tetrahedron Lett.* 1986, 27, 4007. b) Giese, B.; Hoch, M.; **Lamberth, C.**; Schmidt, R. R. *Tetrahedron Lett.* 1988, 29, 1375. c) Kast, **J.**; Hoch, **M.**; Schmidt, R. R. *Liebigs Ann. Chem.*, 1991, 481.
149. Hamann, H.-J; Höft, E.; Mostowicz, D.; Mishnev, A.; **Urbanczyl-Lipkowska, Z.**; **Chmielewski, M.** *Tetrahedron* 1997, 53, 185.
150. Evans, R.D.; Schauble, J. H. *Synthesis* 1986, 727.