# ORBITAL SYMMETRY CONTROL OF PERICYCLIC REACTIONS

## CHEMISTRY 650 SPRING 2002 R. MAGID

## BOOKS AND REVIEW ARTICLES

## (UPDATED APRIL 24, 2006)

As a means of organizing the review literature for this course, books and articles are grouped beginning on p. 3 under the following headings:

I. Books: General discussions of orbital symmetry theory and pericyclic reactions.

II. Books: Specific reactions that are controlled by orbital symmetry.

III. Books: Theoretical treatments related to orbital symmetry.

IV. Reviews: General discussions of pericyclic reactions: theory and experimental data.

V. Reviews: Specific reactions that are controlled by orbital symmetry.

A. Electrocyclic reactions

B. Cycloadditions

C. Sigmatropic reactions

D. Miscellaneous reactions

E. Reactions in two or more of categories A-D

VI. Reviews: Theoretical treatments related to orbital symmetry.

Most of the books in I-III are on reserve in the main library. Some are in the Chemistry Department Reading Room (room 653). Those that the library doesn't have may often be found in the extensive(??) private collection of RMM. Within each heading, the articles have been arranged more or less chronologically; where it appeared appropriate to collect articles on similar topics, this was done. Nearly all of these articles are written in English. Those that aren't can be identified by their foreign language titles.

Discussions of orbital symmetry are now appearing in nearly all of the new undergraduate and graduate organic texts. A partial listing of some of the better of these brief introductory treatments follows:

Introductory Texts

1. Morrison, R. T.; Boyd, R. N. *Organic Chemistry*, 6th ed.; Allyn and Bacon: Boston, 1992; Chapter 28.

2. Loudon, M. *Organic Chemistry*, 3rd ed.; Benjamin/Cummings: Menlo Park, CA, 1995; Chapter 25.

3. Jones, M., Jr. *Organic Chemistry*, 2nd ed.; Norton, New York, 2000; Chapter 21.

4. Solomons, T. W. G.; Fryhle, *Organic Chemistry*, 7th ed.; Wiley: New York, 1988; Special Topic G.

5. Hornback, J. M. *Organic Chemistry*; Brooks/Cole: Pacific Grove, CA, 1998; Chapter 20.

6. Bruice, P. Y. *Organic Chemistry*, 3rd ed.; Prentice-Hall: Upper Saddle River, NJ, 2001; Chapter 28.

7. Fessenden, R. J.; Fessenden, J. S. *Organic Chemistry*, 6th ed.; Brooks/Cole, Pacific Grove, CA, 1998; Chapter 21.

8. McMurry, J. *Organic Chemistry*, 5th ed.; Pacific Grove, CA, 2000; Chapter 30.

Advanced Texts


1. Breslow, R. *Organic Reaction Mechanisms: An Introduction*, 2nd ed.; W. A. Benjamin: New York, 1969; Chapter 8 and Special Topics 4 and 8.

2. Alder, R. W.; Baker, R.; Brown, J. M. *Mechanism in Organic Chemistry*; Wiley-Interscience: London, 1971; Chapter 4.

3. Hirsch, J. A. *Concepts in Theoretical Organic Chemistry*; Allyn and Bacon: Boston, 1974; Chapter 3.

4. Gilliom, R. D. *Introduction to Physical Organic Chemistry*; Addison-Wesley: Reading, MA, 1970; Chapter 4.

5. le Noble, W. J. *Highlights of Organic Chemistry: An Advanced Textbook*; Marcel Dekker: New York, 1974; Chapters 11 and 14.

6. Kosower, E. M. *An Introduction to Physical Organic Chemistry*; John Wiley and Sons: New York, 1968; Chapters 1.8 and 1.9.

7. Sykes, P. *A Guidebook to Mechanism in Organic Reactions*, 5th ed.: Longman: London, 1981; Chapter 12.

8. Harris, J. M.; Wamser, C. C. *Fundamentals of Organic Reactions Mechanisms*; John Wiley and Sons: New York, 1976; Chapter 2.

9. Lowry, T. H.; Richardson, K. S. *Mechanism and Theory in Organic Chemistry*, 3nd ed.; Harper and Row: New York, 1987; Chapters 10-12.

10. Jones, R. A. Y. *Physical and Mechanistic Organic Chemistry*, 2nd ed.; Cambridge: Cambridge, 1984; Chapter 16.

11. Smith, M. B.; March, J. *March's Advanced Organic Chemistry*, 5th ed.; Wiley-Interscience: New York, 2001; Chapters 15 and 18.

12. Carey, F. A.; Sundberg, R. J. *Advanced Organic Chemistry*, 4th ed.; Plenum: New York, 2000; Part A, Chapter 11 and Part B, Chapter 6.

13. Klumpp, G. *Reactivity in Organic Chemistry*; Wiley-Interscience: New York, 1980; Chapter 5.

14. Carpenter, B. K. *Determination of Organic Reaction Mechanisms*; Wiley-Interscience: New York, 1984.

15. Grossman, R. B. *The Art of Writing Reasonable Organic Reaction Mechanisms*; Springer: New York, 1999; Chapter 4

16. Jacobs, A. *Understanding Organic Reaction Mechanisms*; Cambridge: Cambridge, 1997; Chapter 6.

17. Miller, B. *Advanced Organic Chemistry. Reactions and Mechanisms*; Prentice-Hall: Upper Saddle River, NJ, 1998; Chapters 2, 3, and 4.

18. Stowell, J. C. *Intermediate Organic Chemistry*, 2nd ed.; Wiley-Interscience: New York, 1994; Chapter 8.

19. Isaacs, N. S. *Physical Organic Chemistry*; Longman: Essex, 1987; Chapter 14.

20. Carroll, F. A. *Perspectives on Structure and Mechanism in Organic Chemistry*; Brooks/Cole, Pacific Grove, CA, 1997; Chapter 11.

## I. Books: General Discussion


1. Woodward, R. B.; Hoffmann, R. *The Conservation of Orbital Symmetry*; Verlag Chemie: Weinheim, FRG, 1971.
2. Gilchrist, T. L.; Storr, R. C. *Organic Reactions and Orbital Symmetry*, 2nd ed.; Cambridge: Cambridge, 1979
3. Gill, G. B.; Willis, M. R. *Pericyclic Reactions*; Chapman and Hall: London, 1974.
4. Lehr, R.; Marchand, A. *Orbital Symmetry: A Problem Solving Approach*; Academic: New York, 1971.
5. Bellamy, A. J. *An Introduction to Conservation of Orbital Symmetry*; Longman: London, 1974.
6. Anh, N. T. *Les Règles de Woodward-Hoffmann*; Ediscience: Paris, 1970.
7. *Orbital Symmetry Papers (An ACS Reprint Collection)*; Simmons, H. E.; Bunnett, J. F., Eds.: American Chemical Society: Washington, DC, 1974.
8. Fleming, I. *Frontier Orbitals and Organic Chemical Reactions*; Wiley-Interscience: London, 1976.
9. *Pericyclic Reactions*; Marchand, A. P.; Lehr, R. E., Eds.; Academic Press: New York, 1977; Vol. 1.
10. *Pericyclic Reactions*; Marchand, A. P.; Lehr, R. E., Eds.; Academic Press: New York, 1977; Vol. II.
11. Desimoni, G.; Tacconi, G.; Barco, A.; Pollini, G. P. *Natural Products Synthesis Through Pericyclic Reactions*; American Chemical Society: Washington, DC, 1983.
12. Hargittai, I.; Hargittai, M. *Symmetry Through The Eyes of a Chemist*; VCH: New York, 1986.
13. Fleming, I. *Pericyclic Reactions*; Oxford: New York, 1999.


## II. Books: Specific Reactions


1. Hamer, J. *1,4-Cycloaddition Reactions: The Diels-Alder Reaction in Heterocyclic Synthesis*; Academic: New York, 1967.
2. Muller, L. L.; Hamer, J. *1,2-Cycloaddition Reactions: The Formation of Three- and Four-membered Heterocycles*; Interscience: New York, 1967
3. Ulrich, H. *Cycloaddition Reactions of Heterocumulenes*; Academic: New York, 1967.
4. *Selected Molecular Rearrangements*; Stevens, T. S.; Watts, W. E., Eds.; Van Nostrand Reinhold: London, 1973.
5. *Mechanisms of Molecular Migrations*; Thyagarajan, B. S., Ed.; Wiley-Interscience: New York, Vol. 1 (1968), 2 (1969), 3 (1971), 4 (1971).
6. DePuy, C. H.; Chapman, O. L. *Molecular Reactions and Photochemistry*; Prentice-Hall: Englewood Cliffs, NJ, 1972.
7. Coxon, J. M.; Halton, B. *Organic Photochemistry*; Cambridge: Cambridge, 1974.
8. Arnold, D. R.; Baird, N. C.; Bolton, J. R. Brand, J. C. D.; Jacobs, P. W. M.; de Mayo, P.; Ware, W. E. *Photochemistry: An Introduction*; Academic: New York, 1974.
9. Horspool, W. M. *Aspects of Organic Photochemistry*; Academic: London, 1976.
10. *Organic Photochemical Syntheses*; Srinivasan, R., Ed.; Wiley-Interscience: New York, Vol. l, 1971 and Vol. 2, 1976.
11. Barltrop, J. A.; Coyle, J. D. *Excited States in Organic Chemistry*; John Wiley and Sons: London, 1975.
12. Ginsburg, D. *Propellanes. Structure and Reactions*; Verlag Chemie: Weinheim, FRG, 1975.
13. Marvell, E. N. *Thermal Electrocyclic Reactions*; Academic: New York, 1980.

14. *Reactive Intermediates*; Jones, M., Jr.; Moss, R. A., Eds.; Wiley-Interscience: New York, 1978, Vol. I.

15. *Rearrangements in Ground and Excited States*; de Mayo, P., Ed.; Academic; New York, 1980, Vol. 2..

16. Wasserman, H. H.; Murray, R. W. *Singlet Oxygen*; Academic: New York, 1979.

17. Gajewski, J. J. *Hydrocarbon Thermal Isomerizations*; Academic: New York, 1981.

18. Wentrup, C. *Reactive Molecules. The Neutral Reactive Intermediates in Organic Chemistry*; Wiley-Interscience: New York, l984.

19. Taber, D. F. *Intramolecular Diels-Alder and Alder Ene Reactions*; Springer-Verlag: Berlin, l984.

20. Boger, D. L.; Weinreb, S. N. *Hetero Diels-Alder Methodology in Organic Synthesis*; Academic: San Diego, CA, 1987.

21. *Advances in Cycloaddition*; Curran, D. P., Ed.; JAI: Greenwich, CT, 1988; Vol. 1.

22. *Advances in Cycloaddition*; Curran, D. P., Ed.; JAI: Greenwich, CT, 1990; Vol. 2.

23. *Advances in Cycloaddition*; Curran, D. P., Ed.; JAI: Greenwich, CT, 1993; Vol. 3.

24. *Advances in Cycloaddition*, Lautens, M., Ed.; JAI: Greenwich, CT, 1997 Vol. 4.

25.*Advances in Cycloaddition*, Harmata, M., Ed.; JAI: Stamford, CT, 1999 Vol. 5

26.*Advances in Cycloaddition*, Harmata, M. Ed.; JAI: Stamford, CT, 1999 Vol. 6

27. Carruthers, W. *Cycloaddition Reactions in Organic Synthesis*; Pergamon: Oxford, 1990.

28. Fringuelli, F.; Taticchi, A. *Dienes in the Diels-Alder Reaction*; Wiley: New York, 1990.

29. Giuliano, R. M., Ed. *Cycloaddition Reactions in Carbohydrate Chemistry*; ACS: Washington, D.C., 1992.

30. Ho, T.-L. *Tandem Organic Reactions*; Wiley-Interscience: New York, 1992; Chapters 7-12.

31.Ansari, F. L.; Qureshi, R.; Qureshi, M. L. *Electrocyclic Reactions. From Fundamentals to Research*; Wiley-VCH: Weinheim, 1999.

32.Hopf, H. *Classics in Hydrocarbon Chemistry*; Wiley-VCH: Weinheim, FDR, 2000.

33. Kobayashi, S.; Jørgensen, K. A., Eds.; *Cycloaddition Reactions in Organic Synthesis*; Wiley-VCH: Weinheim, FDR, 2002.

34.Fringuelli, F.; Taticchi, A. *The Diels-Alder Reaction: Selected Practical Methods*; Wiley: West Sussex, Eng, 2002

## III. Books: Theoretical Treatments

1. Dewar, M. J. S. *Molecular Orbital Theory of Organic Chemistry*; McGraw-Hill: New York, 1969.

2. Jorgensen, W. L.; Salem, L. *The Organic Chemist's Book of Orbitals*; Academic: New York, 1973.

3. Smith, W. B. *Molecular Orbital Methods in Organic Chemistry: HMO and PMO*; Marcel Dekker: New York, 1974.

4. *Chemical Reactivity and Reaction Paths*; Klopman, G., Ed.; Wiley- Interscience: New York, 1974.

5. Borden, W. T. *Modern Molecular Orbital Theory for Organic Chemistry*; Prentice-Hall: Englewood Cliffs, NJ, 1975.

6. Dewar, M. J. S.; Dougherty, R. C. *The PMO Theory of Organic Chemistry*; Plenum/Rosetta: New York, 1975.

7. Zimmerman, H. E. *Quantum Mechanics for Organic Chemists*; Academic: New York, 1975.

8. Fukui, K. *Theory of Orientation and Stereoselection*; Springer-Verlag: Berlin, 1975.

9. Pearson, R. G. *Symmetry Rules for Chemical Reactions. Orbital Topology and Elementary Processes*; Wiley-Interscience: New York, 1976.

10. Epiotis, N. D. *Theory of Organic Reactions*; Springer-Verlag: Berlin, 1975.

11. *Quantum Theory of Chemical Reactions*; Daudel, R.; Pullman, A.; Salem, L.; Veillard, A., Eds.; Reidel: Dordrecht, Holland, 1980.

12. Yates, K. *Hückel Molecular Orbital Theory*; Academic: New York, 1978.

13. Salem, L. *Electrons in Chemical Reactions. First Principles*; John Wiley and Sons: New York, 1982.

14. Simons, J. *Energetic Principles of Chemical Reactions*; Jones and Bartlett: Boston, 1983.

15.Halevi, E. A. *Orbital Symmetry and Reaction Mechanism. The OCAMS View*; Springer-VerlagL Berlin, 1992.

16. Traven, V. F. *Frontier Orbitals and Properties of Organic Molecules*; Ellis Horwood: New York, 1992.

17. Rauk, A. *Orbital Interaction Theory of Organic Chemistry*; Wiley: New York, 1994.

18. Rauk, A. *Orbital Interaction Theory of Organic Chemistry*, 2nd ed.; Wiley-Interscience: New York, 2001.

## IV. Reviews: General Discussions

1. The Conservation of Orbital Symmetry.
Hoffmann, R.; Woodward, R. B. *Acc. Chem. Res*. **1968**, *1*, 17.

2. The Conservation of Orbital Symmetry.
Woodward, R. B. *Chem. Soc., Spec. Publ. No. 21* **1967**, 217.

3. The Conservation of Orbital Symmetry.
Woodward, R. B.; Hoffmann, R. *Angew. Chem., Int. Ed. Engl.* **1969,** *8*, 781.

4. Orbital Symmetry Control of Chemical Reactions.
Hoffmann, R.; Woodward, R. B. *Science* **1970**, *167*, 825.

5. The Application of the Woodward-Hoffmann Orbital Symmetry Rules to Concerted Organic Reactions.
Gill, G. B. *Q. Rev. Chem. Soc*. **1968**, *22*, 338.

6. Aromaticity and Pericyclic Reactions.
Dewar, M. J. S. *Angew. Chem., Int. Ed. Engl.* **1971**, *10.* 761.

7. Pericyclic Reactions.
Houk, K. N. *Surv. Prog. Chem*. **1973**, *6*, 113.

8. The Variety of Thermal Pericyclic Reactions.
Hendrickson, J. B. *Angew. Chem., Int. Ed. Engl.* **1974**, *13*, 46.

9. The Theory of Pericyclic Reactions.
Epiotis, N. D. *Ibid*. **1974**, *13*, 751.

10. The Woodward-Hoffmann Rules - An Elementary Approach.
Perrin, C. L. *Chem. Brit.* **1972**, 8, 163.

11. Stereoselection in the Elementary Steps of Organic Reactions.
Miller, S. I. *Adv. Phys. Org. Chem*. **1968**, *6*, 185.

12. Transition Structures of Hydrocarbon Pericyclic Reactions.
Houk, K. N.; Evanseck, J. D. *Angew. Chem., Int. Ed. Engl.* **1991**, *31,* 682..

13. Organizing Principle of Complex Reactions and Theory of Coarctate Transition States.
Herges, R. *Angew. Chem., Int. Ed. Engl.* **1994**, *33*, 255.

14. Pericyclic Reaction Transition States: Passions and Punctilios, 1935-1995.
Houk, K. N.; Gonzalez, J.; Li, Y. *Acc. Chem. Res.* **1995**, *28,* 81.

## V. Reviews: Specific Reactions

### A. Electrocyclic Reactions

1. Woodward-Hoffmann Rules: Electrocyclic Reactions.
Vollmer, J. J.; Servis, K. L. *J. Chem. Educ*. **1968**, *45*, 214.

2. Isomerizations in Cyclobutenes.
Criegee, R. *Angew. Chem., Int. Ed. Engl.* **1968**, *7*, 559.

3. The Resonance Energy of Transition States. The Cyclobutene-Butadiene Energy Surface.
Stephenson, L. M., Jr.; Brauman, J. I. *Acc. Chem. Res*. **1974**, *7*, 65.

4. Valence Bond Isomers of Aromatic Systems.
van Tamelen, E. E. *Ibid*. **1972**, *5*, 186.

5. Valence Isomerism in Selected Heterocyclic Systems.
Paquette, L. A. *Angew. Chem., Int. Ed. Engl.* **1971**, *10*, 11.

6. 10π-Electron Analogs of Tropylium Ion, Tropone, and the Tropolones.
Vogel, E. *XXIIIrd Int. Congr. Pure Appl. Chem*. **1971**, *1*, 275.

7. The Norcaradiene Problem.
Maier, G. *Angew. Chem., Int. Ed. Engl.* **1967**, *6*, 402.

8. Benzene Oxide-Oxepin Valence Tautomerism.
Vogel, E.; Günther, H. *Ibid*. **1967**, *6*, 385.

9. Arene Oxides and the NIH Shift: The Metabolism, Toxicity, and Carcinogenicity of Aromatic Compounds.
Daly, J. W.; Jerina, D. M.; Witkop, B. *Experientia* **1972**, *28*, 1129.

10. Excited State Intermediates in Solution Photochemistry.
Ullman, E. F. *Acc. Chem. Res*. **1968**, *1*, 353.

11. Steric Aspects of the Photochemistry of Conjugated Dienes and Trienes.
Dauben, W. F.; Kellogg, M. S.; Seeman, J. I.; Vietmayer, N. D.; Wendschuh, P. H. *Pure Appl. Chem*. **1973**, *33*, 197.

12. The Photochemistry of Cycloheptadienones.
Hart, H. *Ibid*. **1973**, *33*, 247.

13. Photochemistry of Linearly Conjugated Cyclohexadienes in Solution.
Quinkert, G. *Ibid.* **1973**, *33*, 285.

14. Dienyl Rearrangements.
Perkins, M. J.; Ward, P. *Mech. Molec. Migr*. **1971,** *4*, 55.

15. Dienylic and Polyenylic Cations.
Sorenson, T. S. In *Carbonium Ions*; Olah, G. A.; Schleyer, P. von R., Eds.; Wiley-Interscience: New York, 1970; Vol. II, p 807.

16. The Photochemistry of Carbonium Ions.
Cabell-Whiting, P. W.; Hogeveen, H. *Prog. Phys. Org. Chem.* **1973**, *10*, 129.

17. Nitrenium Ions.
Gassmann, P. *Acc. Chem. Res.* **1970**, *3*, 26.

18. Cyclopropanones.
Turro, N. J. *Ibid.* **1969**, *2*, 25.

19. Synthesis of Cyclopropyl Ethers and Cyclopropanols by Carbene Transfer. Acetolysis of Cyclopropyl p-Toluenesulfonates.
Schöllkopf, U. *Angew. Chem., Int. Ed. Engl.* **1968**, *7*, 588.

20. The Chemistry of Cyclopropanols.
DePuy, C. H. *Acc. Chem. Res.* **1968**, *1*, 33.

21. Cyclopropanol Chemistry.
Gibson, D. H.; DePuy, C. H. *Chem. Rev.* **1974**, *74*, 605.

22. Nitrogen as Leaving Group: Aliphatic Diazonium Ions.
Kirmse, W. *Angew. Chem., Int. Ed. Engl.* **1976**, *15*, 25.

23. Introduction of Fluorine into Organic Molecules: Why and How.
Schlosser, M. *Tetrahedron* **1978**, *34*, 3.

24. Ring Opening Reactions of Aziridines and Oxiranes.
Huisgen, R. *XXIIIrd Int. Congr*. *Pure Appl. Chem.* **1971**, *1*, 175.

25. Photochemistry of Some Three Membered Heterocycles.
Trozzolo, A. M.; DoMinh, T. *Ibid.* **1971**, *2*, 251.

26. Reactive Species from the Electrocyclic Opening of Three-Membered Heterocycles.
Lown, J. W. *Rev. React. Species Chem. React*. **1974**, *1*, 89.

27. Electrocyclic Ring Opening Reactions of Ethylene Oxides.
Huisgen, R. *Angew. Chem., Int. Ed. Engl.* **1977**, *16*, 572.

28. Stereochemistry of Reaction Paths as Determined from Crystal Structure Data - A Relationship Between Structure and Energy.
Bürgi, H.-B. *Ibid.* **1975**, *14*, 460.

29. Polycyclic Systems Containing Small-Membered Rings.
Garratt, P. J. *Pure Appl. Chem.* **1975**, *44*, 783.

30. Hohengliedrige Annulenylionen und Bemerkungen zur Frage den Konfigurations- und Konformations-Stabilität bei Annulenen.
Schröder, G. *Ibid.* **1975**, *44*, 925.

31. Results of Carbon-13 NMR Spectroscopy in the Field of Conjugated π-Electron Systems.
Günther, H.; Schmickler, H. *Ibid.* **1975**, *44*, 807.

32. Aromatic and Heteroaromatic Compounds by Electrocyclic Ring-Closure with Elimination.
Jutz, J. C. *Top. Curr. Chem.* **1978**, *73*, 125.

33. Photochemistry of Some Three-Membered Heterocycles.
Trozzolo, A. M.; Leslie, T. M.; Sarpotdar, A. S.; Small, R. D.; Ferraudi, G. M. *Pure Appl. Chem.* **1979**, *51*, 261.

34. 1,5-Dipolar Cyclizations.
Taylor, E. C.; Turchi, I. J. *Chem. Rev.* **1979**, *79*, 181.

35. 1,5-Electrocyclizations - An Important Principle of Electrocyclic Chemistry.
Huisgen, R. *Angew. Chem., Int. Ed. Engl.* **1980**, *19*, 947.

36. Nucleophilic Substitution Reactions of Cyclopropane Derivatives.

Aksenov, V. S.; Terent'eva, G. A.; Savinykh, Y. V. *Russ. Chem. Rev.* **1980**, *49*, 549.

37. Synthetic Approaches to Vitamin D and Its Relatives.
Lythgoe, B. *Chem. Soc. Rev.* **1981**, *9*, 449.

38. Thiepins and Benzothiepins: The Conquest of Elusive Sulfur Heterocycles.
Reinhoudt, D. N. *Recl. Trav. Chim. Pays-Bas* **1982**, *101*, 277.

39. Photochemical Cyclizations and Intramolecular Cycloadditions of Conjugated Arylolefins. Part I: Photocyclizations with Dehydrogenation.
Laarhoven, W. H. *Ibid.* **1983**, *102*, 185.

40. Photochemical Cyclizations and Intramolecular Cycloadditions of Conjugated Arylolefins. Part II. Photocyclizations Without Dehydrogenation and Photocycloaddition.
Laarhoven, W. H. *Ibid.* **1983**, *102*, 241.

41. The Nazarov Reaction.
Santelli-Rouvier, C.; Santelli, M. *Synthesis* **1983**, 429.

42. Synthèse des Métabolites de la Vitamine D.
Pardo, R.; Santelli, M. *Bull. Soc. Chim. Fr.* **1985**, II-98.

43. Multi-electron (12π - 20π) Pericyclic Processes.
Prinzbach, H.; Knothe, L. *Pure Appl. Chem.* **1986**, *58*, 25.

44. Synthesis and Reactions of Dewar Furans (5-Oxabicyclo[2.1.0]pent-2-enes).
Warrener, R. N.; Russell, R. A.; Pitt, I. G. *Ibid.* **1986**, *58*, 161.

45. Perspectives in Photochromism: A Novel System Based on 1,5-Electrocyclization of Heteroanalogous Pentadienyl Anions.
Dürr, H. *Angew. Chem., Int. Ed. Engl.* **1989**, *28*, 412.

46. Carbonyl Oxides: Zwitterions or Diradicals?
Sander, W. *Angew. Chem., Int. Ed. Engl.* **1990**, *29,* 345.

47. 1,7-Electrocyclic Reactions of α,β,γ-Unsaturated 1,3-Dipoles as a Synthetic Route to Seven-membered Heterocycles.
Zecchi, G. *Synthesis* **1991,** 181.

48. The Current View of Dynamic Change with Cyclooctatetraenes.
Paquette, L. A. *Acc. Chem. Res.* **1993**, *26,* 57.

49. Techniques and Applications of Far-UV Photochemistry in Solution. The Photochemistry of the $C_3H_4$ and $C_4H_6$ Hydrocarbons.
Leigh, W. J. *Chem. Rev.* **1993**, *93,* 487.

50. Orbital Symmetry and the Photochemistry of Cyclobutene.
Leigh, W. J. *Can. J. Chem.* **1993**, *71,* 147

51. *gem*-Dihalocyclopropanes in Chemical Synthesis.
Bamwell, M. G.; Reum, M. E. In *Advances in Strain in Organic Chemistry*; Halton, B., Ed.; JAI: London, 1991; Vol. 1, p 1.

52. The Nazarov Cyclization.
Habermas, K. L.; Denmark, S. E.; Jones, T. K. *Org. React.* **1994**, *45*, 159.

53. Cyclooctatetraenes; Conformational and π-Electron Dynamics with Polyolefinic [8] Annulene Frameworks.
Paquette, L. A. *Adv. Theoret. Int. Mol.* **1992**, *2,* 1.

54. The Dewar Furan Story: A New Chapter in the Development of Synthetic Protocols for Unsaturated Cyclic Compounds Involving Acetylene Stacking and Transfer Technology.

Warrener, R. N. *Adv. Theoret. Int. Mol.* **1992**, *2,* 143.

55. The Changing Face of Arene Oxide-Oxepine Chemistry.
Boyd, D. R.; Sharma, N. D. *Chem. Soc. Rev.* **1996**, *25,* 289.

56. The Metacyclophanediene-Dihydropyrene Photochromic π Switch.
Mitchell, R. H. *Eur. J. Org. Chem.* **1999**, 2695.

57. Naphthocyclobutenes and Benzodicyclobutadienes: Synthesis in the Solid State and Anomalies in the Bond Lengths.
Toda, F. *Eur. J. Org. Chem.* **2000**, 1377.

58. Recent Developments in the Nazarov Process
Pellissier, H. *Tetrahedron* **2005**, *61,* 6479.

59. The Nazarov Cyclization in Organic Synthesis. Recent Advances.
Frontier, A. J.; Collison, C. *Tetrahedron* **2005**, *61,* 7577.

60. Biosynthetic and Biomimetic Electrocyclizations.
Beaudry, C. M.; Malerich, J. P.; Trauner, D. *Chem. Rev.* **2005**, *105,* 4757.

B. Cycloadditions

1. Woodward-Hoffmann Rules: Cycloaddition Reactions.
Vollmer, J. J.; Servis, K. L. *J. Chem. Educ*. **1970**, *47*, 491.

2. Cycloadditions - Definition, Classification, and Characterization.
Huisgen, R. *Angew. Chem., Int. Ed. Engl.* **1968**, *7*, 321.

3. Mechanisms of Cycloaddition.
Bartlett, P. D. *Q. Rev. Chem. Soc*. **1970**, *24*, 473.

4. Four-Membered Rings and Reaction Mechanisms.
Bartlett, P. D. *Chem. Soc. Rev.* **1976**, *5,* 149.

5. Diels-Alder Reactions I: Preparative Aspects.
Sauer, J. *Angew. Chem., Int. Ed. Engl.* **1965**, *5*, 211.

6. Diels-Alder Reactions II: The Reaction Mechanism.
Sauer, J. *Ibid.* **1967**, *6* 16.

7. The Reverse Diels-Alder or Retrodiene Reaction.
Kwart, H.; King, K. *Chem. Rev.* **1967**, *67*, 415.

8. Applications Recentes de la Réaction de Retro-Diels-Alder en Synthèse Organique.
Ripoll, J. L.; Rouessac, A.; Rouessac, F. *Tetrahedron* **1978**, *34*, 19.

9. Stereoselectivity of Diels-Alder Reactions.
Kobuke, Y. *J. Synth. Org. Chem. Jpn*. **1972**, *30*, 992 (in Japanese).

10. The Role of High Pressure Kinetics in Studies of the Transition States of Diels-Alder Reactions.
McCabe, J. R.; Eckert, C. A. *Acc. Chem. Res.* **1974**, *7*, 251.

11. Solvent Effects on Transition States and Reaction Rates.
Abraham, M. H. *Prog. Phys. Org. Chem.* **1974**, *11*, 1.

12. The Intramolecular Diels-Alder Reaction in Organic Synthesis.
Carlson, R. G. *Ann. Rept. Med. Chem*. **1974**, *9*, 270.

13. Molecular Design of Compounds via Intramolecular Diels-Alder Reactions.

Mehta, G. *J. Chem. Educ.* **1976**, *53*, 551.

14. Intramolecular [4+4] and [3+2] Cycloadditions in Organic Synthesis.
Oppolzer, W. *Angew. Chem., Int. Ed. Engl.* **1977**, *16*, 10.

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