

Robert Burns Woodward



April 10, 1917 – July 8, 1979

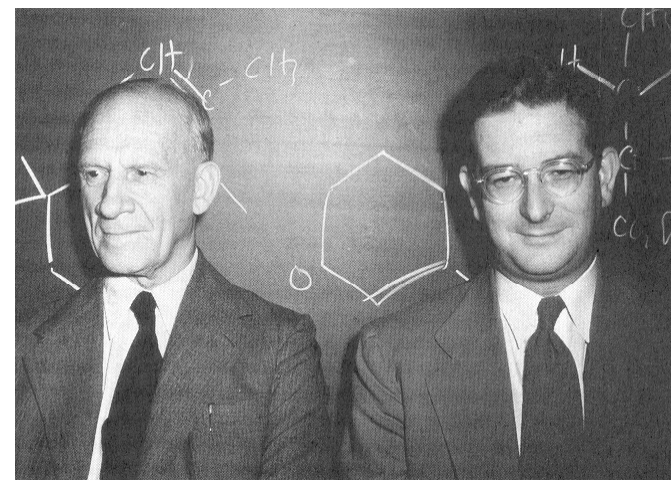
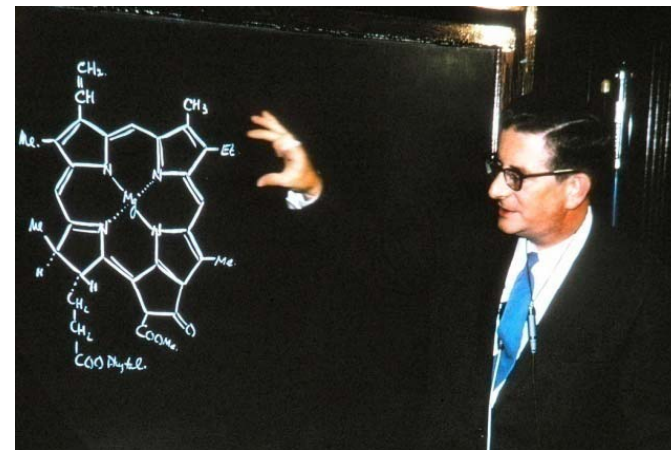
Seth D. Carmody

Group Meeting
March 26, 2010

Intriguing from a Young Age – The Hellion



- Had a basement laboratory at a very young age
- Skipped the 4th, 7th, and 10th grades
- Left high school at sixteen years old – 1933
- Enrolled at MIT – 1933
- First paper – 1934 (age 17)
- Kicked out of MIT – Fall 1934
- Re-enrolled at MIT – Fall 1935
- Achieved B.S. – 1936
- Achieved PhD under James F. Norris – 1937 (age 20)
- Short stint at University of Illinois (postdoctoral)
- Assistantship with E.P Kohler at Harvard – 1937
- Slept 3 hours a night

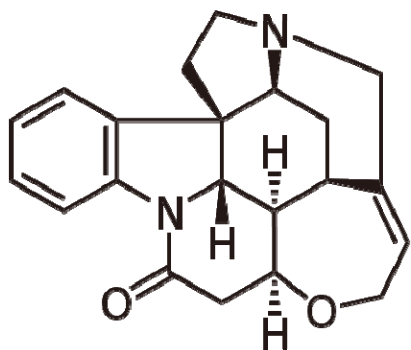


Sir Robert Robinson and Burnside

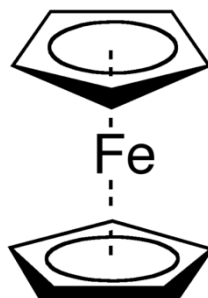
Lord Todd, John Cornforth, A.R.T. and J.W.C. *Biogr. Mem. Fell. R. Soc.* **1981**, 27, 628-695

Elkan Blout *Biogr. Mem. Nat. Acad. Sci.* **2001**, 80, 366-387

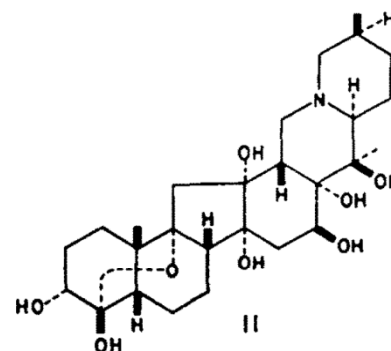
Robert Burns Woodward: Architect and Artist in the World of Molecules; Otto Theodor Benfey, Peter J. T. Morris, Chemical Heritage Foundation, April 2001



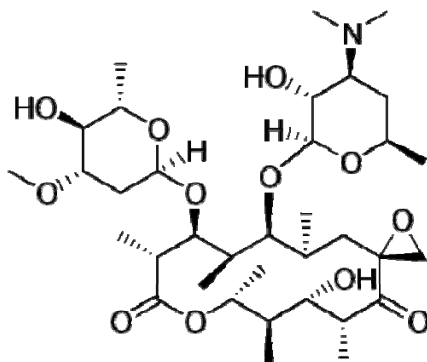
Strychnine – 1947



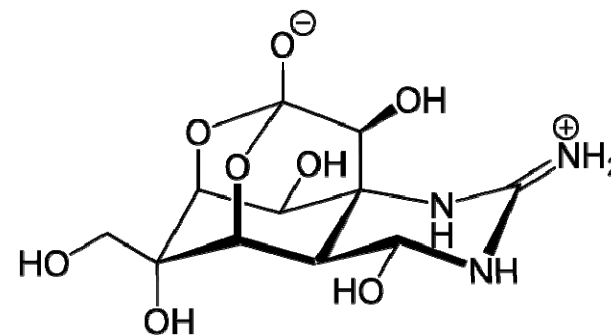
Ferrocene – 1952



Cevine – 1954
with D.H.R Barton



Oleandomycin – 1960

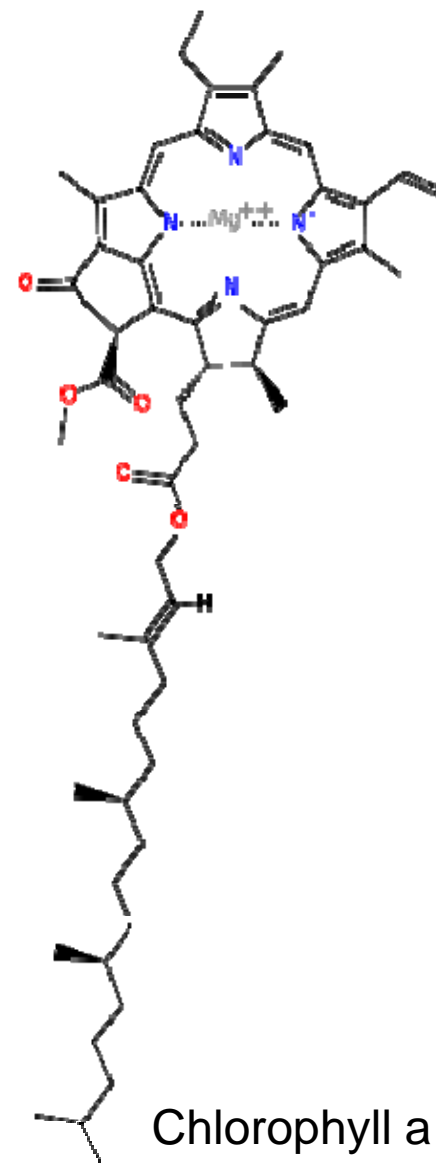
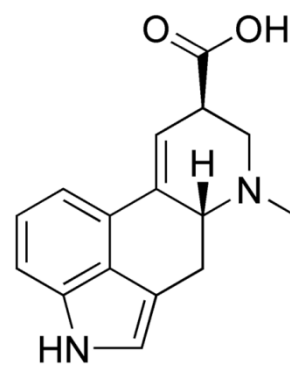
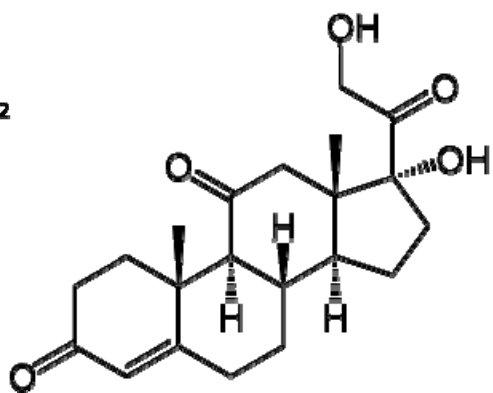
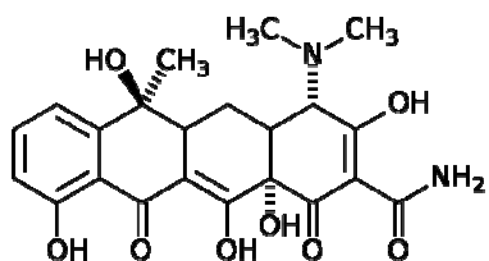
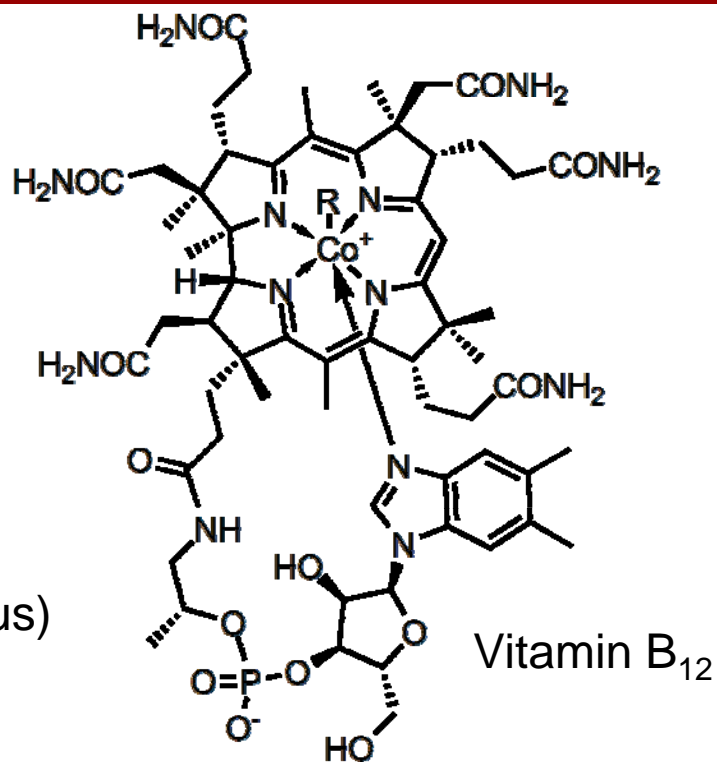


Tetrodotoxin – 1964

Total Syntheses – A sampling



- Quinine – 1944
- Cholesterol - 1951
- Cortisone – 1951
- Strychnine – 1954
- Lysergic acid - 1956
- Chlorophyll – 1960
- Tetracycline – 1962
- Colchicine – 1963
- Cephalosporin C – 1965
- Vitamin B₁₂ - 1972
- Erythromycin – 1981 (posthumous)



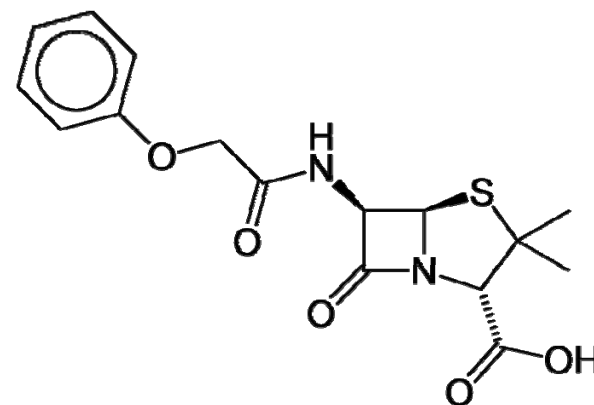
Penicillin V – Chemists at War



Discovered: Sir Alexander Fleming – 1928

Structure: Robert B. Woodward – 1949 (

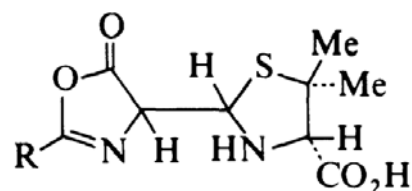
Total Synthesis: John C. Sheenan (MIT) – 1957



Penicillin V

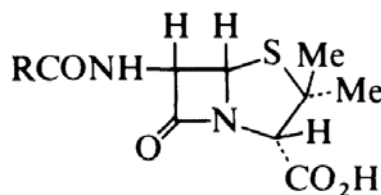
thiazolidine-oxazolone (1)

β -lactam (2)

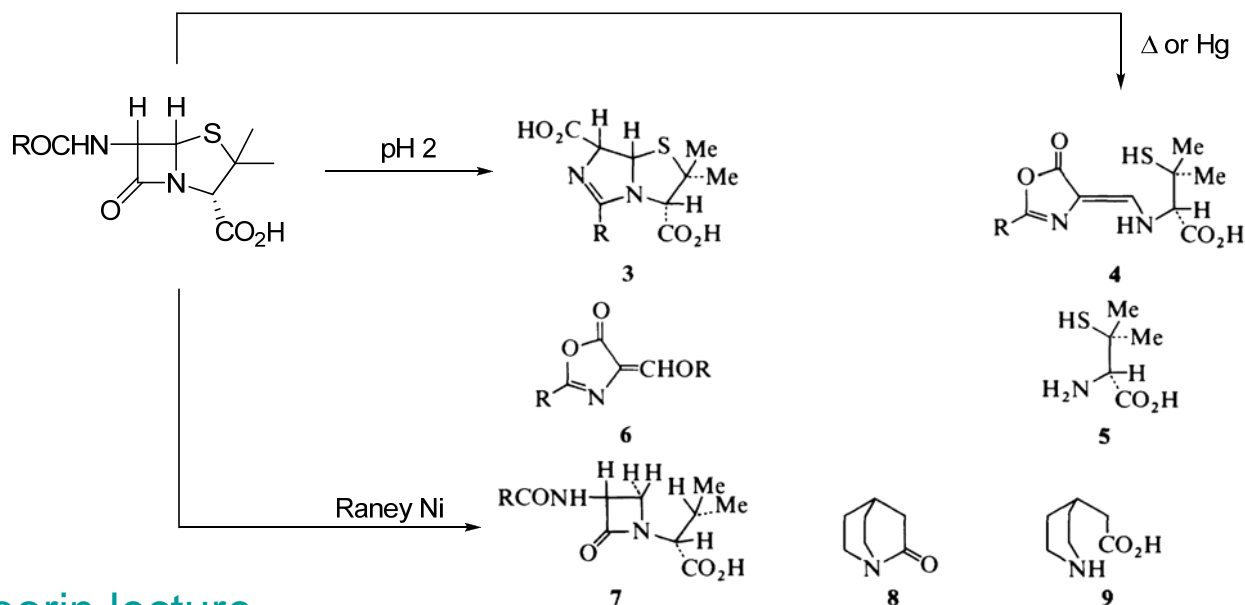


1

R = PhCH₂-, etc.

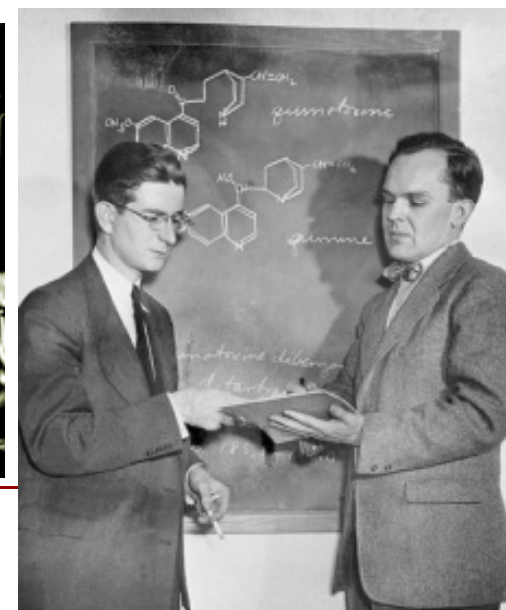
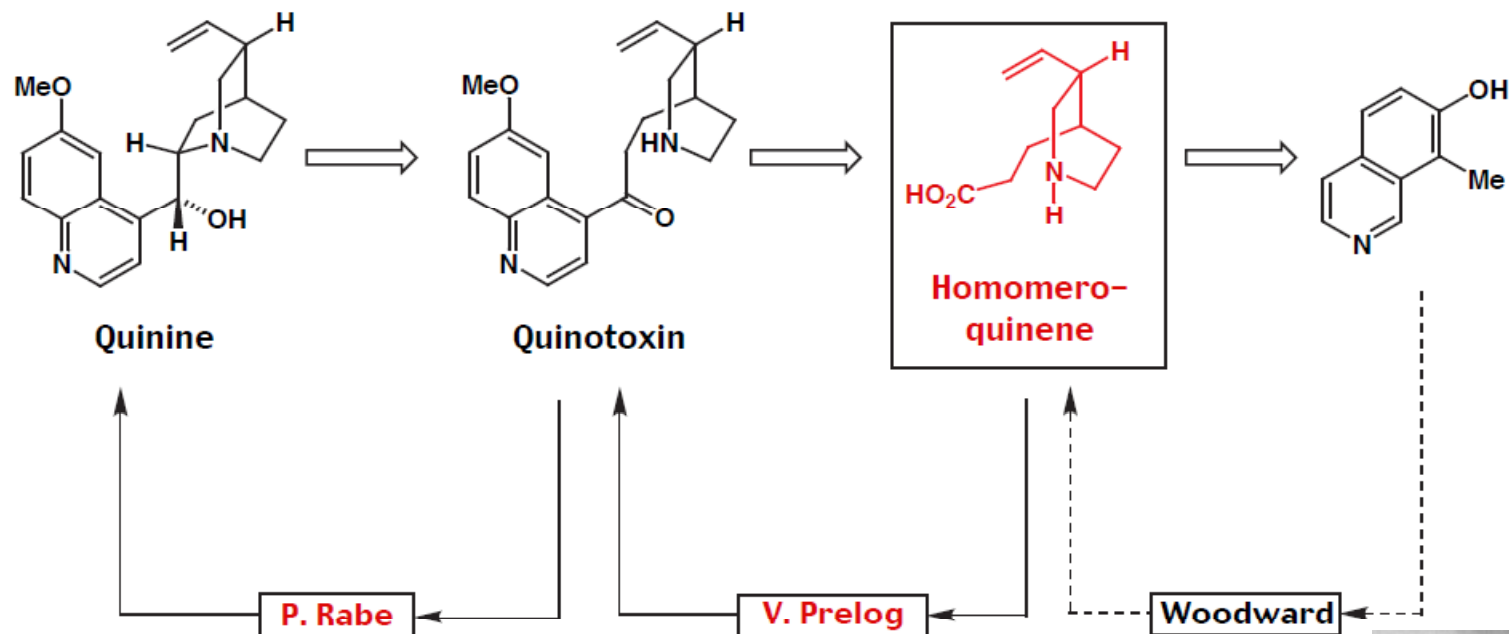


2



[Cephalosporin lecture](#)

Quinine – Chemists at War



Woodward, R. B.; Doering, W. E., *J. Am. Chem. Soc.* **1944**, 66 (5), 849-849
Woodward, R. B.; Doering, W. E., *J. Am. Chem. Soc.* **1945**, 67 (5), 860-874
Seeman, Jeffrey I., *Angew. Chem. Int. Ed.* **2007**, 46 (9), 1378-1413

Appointments and Honorary Degrees - A few to spare



Harvard University: Postdoctoral Fellow 1937–1938; Member of the Society of Fellows 1938–40; Instructor in Chemistry 1941–44; Assistant Professor 1944–46; Associate Professor 1946–50; Professor 1950–53; Morris Loeb Professor of Chemistry 1953–60; Donner Professor of Science 1960–79.

Woodward Research Institute, Basle: Director 1963–79.

Member of Corporation, Massachusetts Institute of Technology 1966–71.

Member of Board of Governors, Weizmann Institute of Science 1968–79.

Member of Board of Directors Ciba-Geigy Ltd, Basle, 1970–79.

Alexander Todd Professor of Chemistry and Fellow of Christ's College, University of Cambridge 1973–74.

LL.D. University of Glasgow, 1966.

Dr.tech.wiss. Eidgenössische Technische Hochschule, 1967.

D.Sc. Wesleyan University, 1945; University of Manchester, 1954; Bucknell University, 1955; University of New Brunswick, 1956; Yale University, 1956; Harvard University, 1957; University of Southern California, 1959; University of Chicago, 1961; New England College of Pharmacy, 1961; Colby College, 1963; University of Cambridge, 1964; Brandeis University, 1965; Stonehill College, 1966; University of Sheffield, 1966; Israel Institute of Technology (Haifa), 1966; Polytechnic Institute of Brooklyn, 1967; University of Western Ontario, 1968; Columbia University, 1969; Université de Louvain, 1970; Université Pierre et Marie Curie de Paris, 1975; University of St. Andrews, 1976; University of London, 1976.

Awards and Accolades – More Medals than Michael Phelps



John Scott Medal (Franklin Institute and City of Philadelphia), 1945; Baekeland Medal (North Jersey Section of the American Chemical Society), 1955; Ledlie Prize (Harvard University), 1955; Research Corporation Award, 1955; Nichols Medal (New York Section of the American Chemical Society), 1956; Synthetic Organic Chemistry Award (American Chemical Society), 1957; Richards Medal (North-eastern Section of the American Chemical Society), 1958; Davy Medal (Royal Society), 1959; Roger Adams Medal (American Chemical Society), 1961; Pius XI Gold Medal (Pontifical Academy of Sciences), 1961; Scientific Achievement Medal (City College Chemistry Alumni Association), 1961; Priestley Medallion (Dickinson College), 1962; Stas Medal (Société Chimique de Belgique) 1962; Gold Medal for Creative Research in Synthetic Organic Chemistry (Synthetic Organic Chemical Manufacturers Association), 1962; National Medal of Science (United States of America), 1964; Kirkwood Medal (Yale Department of Chemistry and New Haven Section of the American Chemical Society), 1965; Nobel Prize in Chemistry (Royal Swedish Academy of Sciences), 1965; Willard Gibbs Medal (Chicago Section of the American Chemical Society), 1967; Lavoisier Medal (Société Chimique de France), 1968, The Order of the Rising Sun, Second Class (His Majesty the Emperor of Japan), 1970, Hanbury Memorial Medal (The Pharmaceutical Society of Great Britain), 1970; Pierre Bruylants Medal (Université de Louvain), 1970; Scientific Achievement Award (American Medical Association), 1971; Dr B. C. Law Gold Medal (Indian Association for the Cultivation of Science), 1972; Arthur C. Cope Award (American Chemical Society), 1973; Copley Medal (Royal Society), 1978.

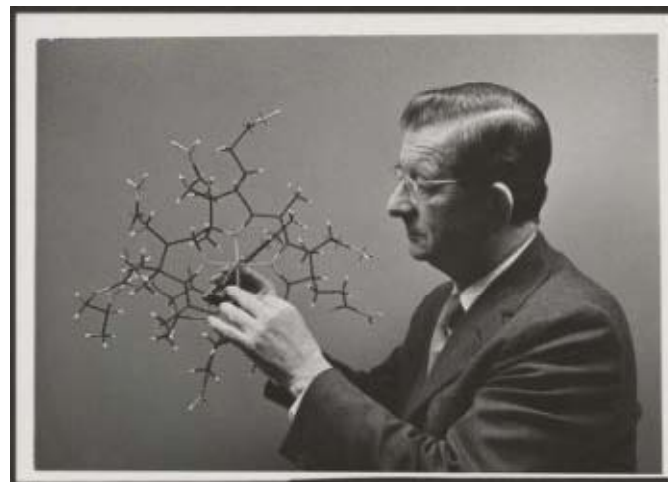


[Nobel lecture](#)

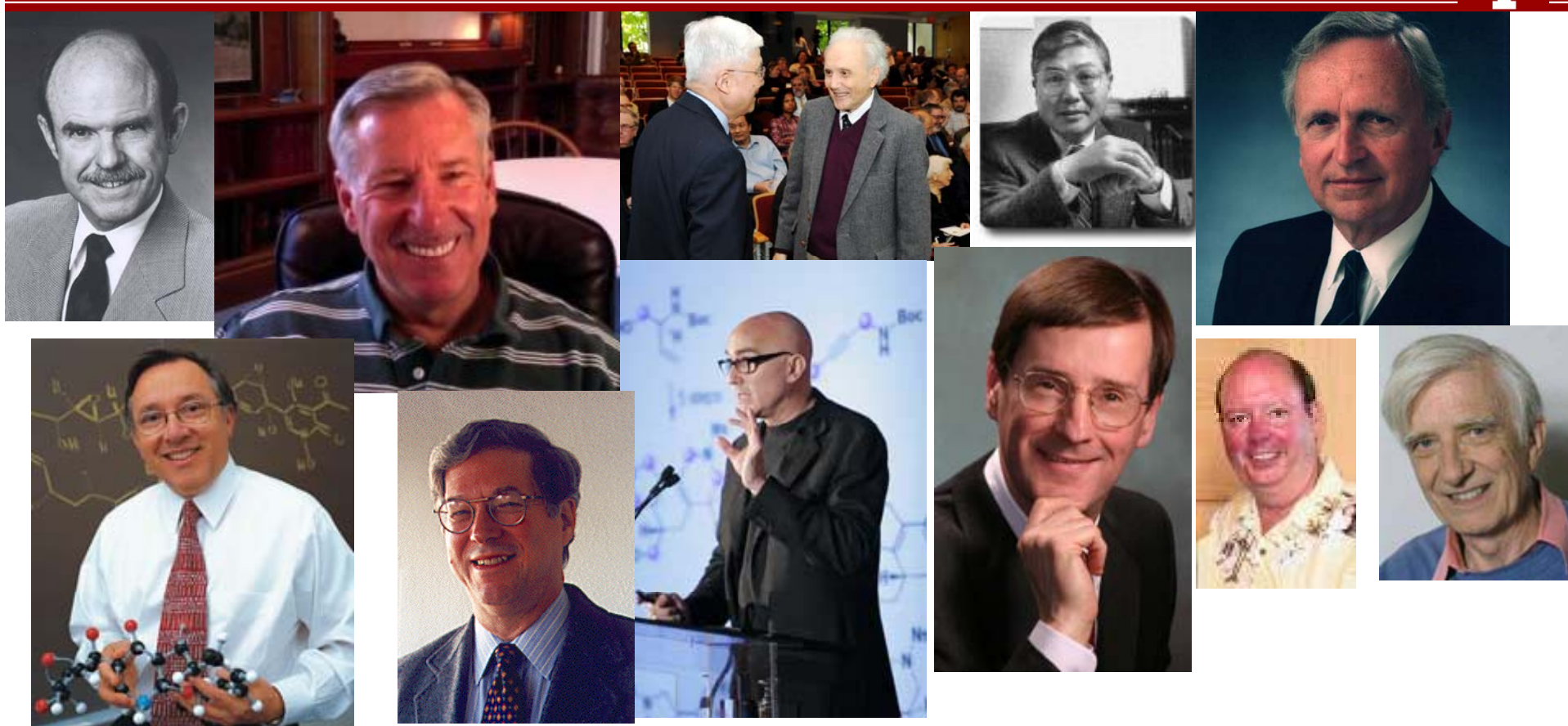
Honorary Membership of Academies and Learned Societies



Member of the National Academy of Sciences; Fellow of the American Academy of Arts and Sciences; Honorary Member of the German Chemical Society; Honorary Fellow of the Chemical Society; Foreign Member of the Royal Society; Honorary Member of the Royal Irish Academy; Corresponding Member of the Austrian Academy of Sciences; Member of the American Philosophical Society; Honorary Member of the Belgian Chemical Society; Honorary Member of the Harvey Society of New York; Honorary Fellow of the Indian Academy of Sciences; Honorary Member of the Swiss Chemical Society; Member of the Deutsche Akademie der Naturforscher (Leopoldina); Foreign Member of the Accademia Nazionale dei Lincei; Honorary Fellow of the Weizmann Institute of Science; Honorary Member of the Pharmaceutical Society of Japan; Honorary Member of the Pharmaceutical Society of Great Britain; Honorary Fellow of the Indian Chemical Society; Honorary Life Member of the New York Academy of Sciences; Foreign Fellow of the Indian National Science Academy; Honorary Member of the Royal Institution of Great Britain; Foreign Member of the Academy of Sciences of the U.S.S.R.; Foreign Member of the Yugoslav Academy of Sciences and Arts; Honorary Member of Phi Lambda Upsilon (National Honorary Chemical Society); Honorary Fellow of the Royal Society of Edinburgh; Foreign Member of the Academy of Sciences of the Institute of France; Honorary Member of the Spanish Royal Society of Physics and Chemistry; Foreign Member of the Royal Academy of Sciences of Spain.



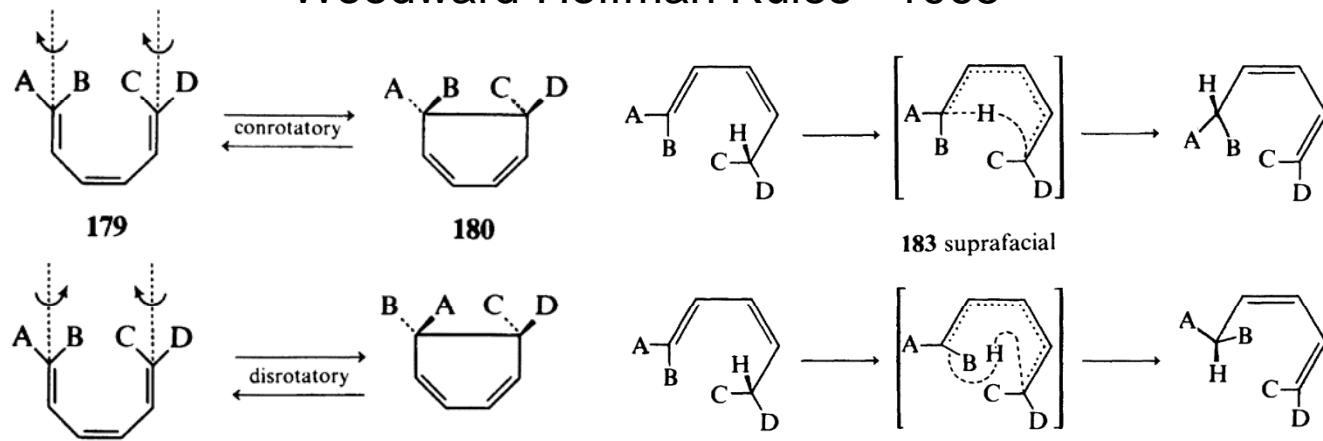
Name that Former Student!



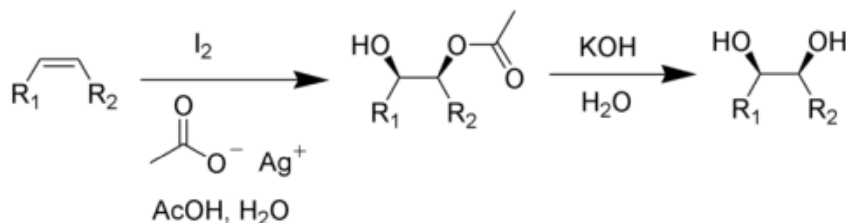
Wasserman, H. H.; Berson, J. A.; Hendrickson, J. B.; Kemp, D. S.; Wenkert, E., *Tetrahedron* **1999**, 55 (34), 10253-10269

- 196 publications including 87 full papers
- >200 grad students and post-docs
- Concept that structure can be deduced spectroscopically
- Woodward (1941)-Fieser (1948) rules (Calculating UV absorption)
- The Woodward

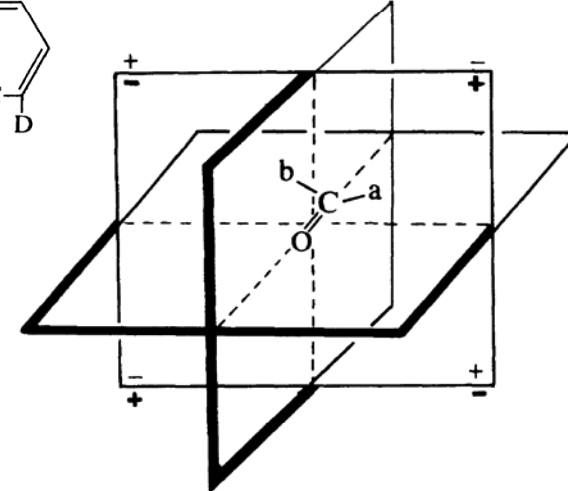
Woodward-Hoffman Rules - 1965



Woodward cis-hydroxylation – 1958



Octant rule - 1961

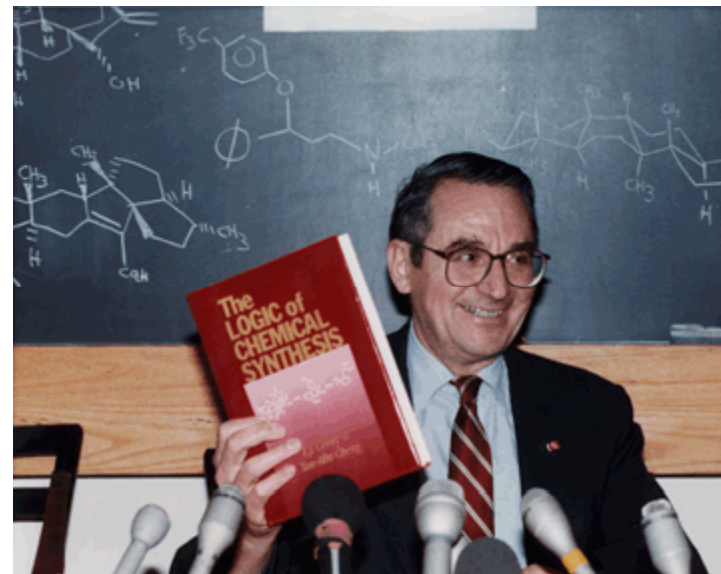
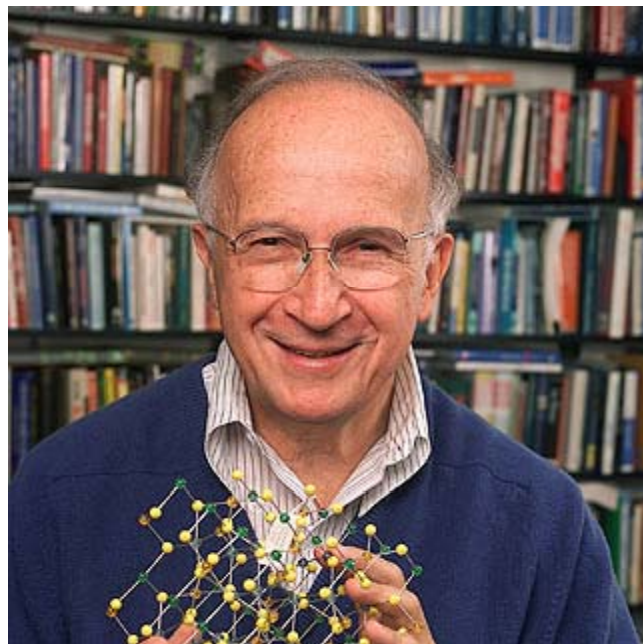


Moffitt, W.; Woodward, R. B.; Moscowitz, A.; Klyne, W.; Djerassi, C., *J. Am. Chem. Soc.* **1961**, 83 (19), 4013-4018

Hoffmann, R.; Woodward, R. B., *Accounts of Chemical Research* **1968**, 1 (1), 17-22

Woodward, R. B.; Brutcher, F. V., *J. Am. Chem. Soc.* **1958**, 80 (1), 209-211

RB Woodward vs EJ Corey – What happened on May 4, 1964?



Woodward had a habit of posing to people problems of great interest. And also of posing such problems as puzzles, even if he had the solution.

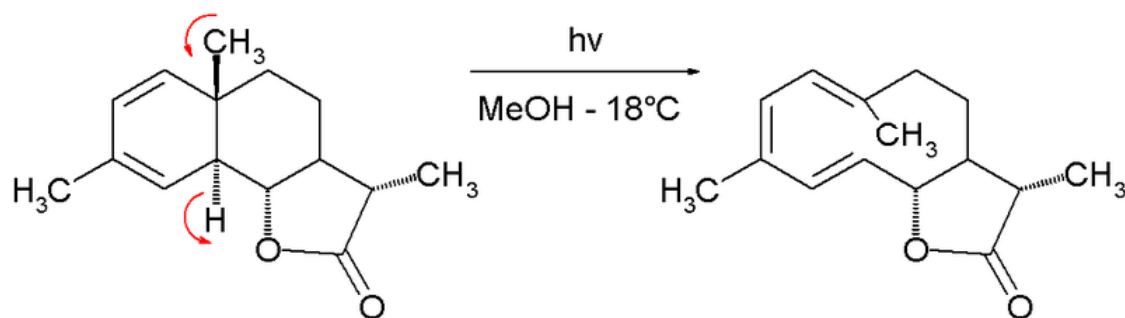
[C&EN Priestly Medal Address](#)

Corey, E. J., *J. Org. Chem.* **2004**, 69 (9), 2917-2919 "Impossible Dreams"

Hoffmann, R., *Angew. Chem. Int. Ed.* **2004**, 43 (48), 6586-6590

“On May 4, 1964, I suggested to my colleague R.B. Woodward a simple explanation involving the symmetry of the perturbed (HOMO) molecular orbitals for the stereoselective cyclobutene/1,3-butadiene and 1,3,5-hexatriene/cyclohexadiene conversions that provided the basis for the further development of these ideas into what became known as the Woodward–Hoffmann rules.”

“You cannot deny that despite the possibility of appalling dishonesty at the roots of your collaboration with Bob, you elected to close your mind. The two of you in effect ”stonewalled“ my contribution so completely that you chose not even to make a perfunctory acknowledgement in your papers.”



“I am amazed that you would think it possible that I would consider doing anything against Harvard, to which I was and am so devoted.”

“I had hoped that Bob himself would do it as he grew older, more considerate, and more sensitive to his own conscience.”