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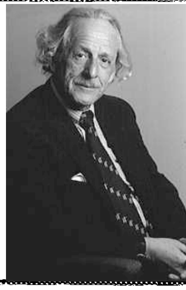

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EUGENE GARFIELD
INSTITUTE FOR SCIENTIFIC INFORMATION®
3501 MARKET ST., PHILADELPHIA, PA 19104

# The Most-Cited 1984 Chemistry Articles 1984-1986: Organic Superconductors and a Potpourri of Chirality, Fractals, and Smog

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The 98 most-cited chemistry articles that were published in 1984 are surveyed. Discussion highlights include the selection process for the papers, research-front activity indicating focused efforts in the field of organic superconductors, geographic and institutional affiliations of the papers, as well as the five most-cited chemistry papers, with emphasis on new examinations of molecular structure. The trends (superconductivity and how molecules bind with each other) were precursors to the 1987 Nobel Prizes in physics and chemistry.

Somewhat belatedly, this essay provides the list of 1984 "chemistry" papers most cited from 1984 to 1986 in the *Science Citation Index*® (*SCI*®) (see Bibliography). Each year since 1983,[1] we have identified groups of highly cited, recently published chemistry papers. This is the fifth such study and includes 98 papers. We have also included 1987 data for each paper.

While our 1983 study was dominated by work dealing with nuclear magnetic resonance, the emphasis in 1984 was on research examining organic superconductors and the molecular mechanisms of complex structures—work that preceded the 1987 Nobel Prizes in both physics and chemistry.[2,3]

Separating most-cited chemistry papers from other fields has been problematic. To help solve these problems, we used a "Chemistry Citation Index," an in-house unpublished subset of the *SCI* limited essentially to the journals covered in *Index Chemicus*®. Even so, many papers identified are in tangential fields such as biochemistry, the earth sciences, physics, and the like. We made a conscious attempt to remove papers that would more appropriately fall into our lists of most-cited life- and physical-sciences papers for 1984. The list was then reviewed by outside referees to further cull papers in peripheral fields. Nevertheless, the papers in the Bibliography still include a number of such papers; for example, two chromatography papers deal with amino-acid analysis—one by Brian A. Bidlingmeyer, Steven A. Cohen, and Thomas L. Tarvin, Waters Associates, Milford, Massachusetts, and the other coauthored by Robert L. Heinrikson and Stephen C. Meredith, Departments of Biochemistry and Pathology, University of Chicago, Illinois (the third most-cited paper in the list). Another paper, authored by Ferdinand Bohlmann and colleagues, Institute for Organic Chemistry, Technical University of Berlin, Federal Republic of Germany (FRG), concerns botanical chemistry, dealing with the makeup of plant aromas.

## Journals

The 41 journals that published the 1984 most-cited chemistry papers are listed in Table 1. They encompass many different areas of chemistry. The *Journal of the American Chemical Society* (*JACS*) continues to dominate these annual studies. *JACS* accounted for 23 papers—5 more than in the previous study. In 1981, however, *JACS* published 74 of the papers listed. Despite its continued prominence, only one paper of the top five in 1984 appeared in *JACS*.

On the other hand, another American Chemical Society (ACS) journal, *Accounts*

**Table 1: The 41 journals that published the papers listed in the Bibliography.** A = the number of papers from each journal that appear in the Bibliography. B = the country of publication of each journal. The numbers in parentheses are the 1984 impact factors for the journals. (The 1984 impact factor equals the number of 1984 citations received by the number of 1982-1983 articles in a journal divided by the number of articles published by the journal during that same period.) Data were taken from the 1984 *JCR*®.

| Journal | A | B | Journal | A | B |
|---|---|---|---|---|---|
| J. Amer. Chem. Soc. (4.43) | 23 | US | CRC Crit. Rev. Sol. St. Mat. Sci. (1.67) | 1 | US |
| Account. Chem. Res. (7.65) | 7 | US | Environ. Sci. Technol. (2.60) | 1 | US |
| Anal. Chem. (3.02) | 5 | US | J. Appl. Cryst. (1.16) | 1 | Denmark |
| * Angew. Chem. Int. Ed. (4.01) | 5 | FRG | J. Biol. Chem. (6.12) | 1 | US |
| | | | J. Carbohyd. Chem. (0.85) | 1 | US |
| Inorg. Chem. (2.60) | 4 | US | | | |
| J. Chem. Phys. (3.00) | 4 | US | J. Catal. (2.65) | 1 | US |
| J. Phys. Chem. (3.11) | 4 | US | J. Chem. Soc. Commun. (2.44) | 1 | UK |
| Nature (10.25) | 3 | UK | | | |
| Phys. Rev. Lett. (6.50) | 3 | US | J. Chromatogr. (1.83) | 1 | The Netherlands |
| Tetrahedron Lett. (2.18) | 3 | US | J. Chromatogr. Sci. (1.81) | 1 | US |
| Annu. Rev. Phys. Chem. (9.54) | 2 | US | J. Mol. Biol. (6.54) | 1 | UK |
| | | | Organic Reactions (9.13) | 1 | US |
| J. Electroanal. Chem. Interfac. (2.40) | 2 | Switzerland | Organometallics (3.26) | 1 | US |
| | | | Phys. Rev. B—Condensed Matter (3.13) | 1 | US |
| J. Magn. Resonance (2.69) | 2 | US | | | |
| | | | Phytochemistry (1.23) | 1 | UK |
| J. Phys. Chem. Ref. Data (4.39) | 2 | US | ** Pisma Zh. Eksp. Teor. Fiz. (1.30) | 1 | USSR |
| Mol. Cryst. Liquid Cryst. (1.28) | 2 | UK | Polyhedron (1.12) | 1 | UK |
| | | | Proc. Nat. Acad. Sci. USA (8.93) | 1 | US |
| Science (8.21) | 2 | US | | | |
| Advan. Organometal. Chem. (10.38) | 1 | US | Prog. Nucl. Magn. Reson. Spectros. (7.70) | 1 | UK |
| Advan. Polym. Sci. (5.56) | 1 | FRG | Pure Appl. Chem. (2.04) | 1 | UK |
| Anal. Biochem. (2.52) | 1 | US | | | |
| Biochemistry—USA (3.84) | 1 | US | | | |
| Can. J. Chem. (1.40) | 1 | Canada | | | |
| Chem. Lett. (1.59) | 1 | Japan | | | |

*also published in German as *Angew. Chem.*
**translated in *JETP Lett.—Engl. Tr.* (1.10)

*of Chemical Research* (*ACR*), provides the second largest group in the Bibliography—seven. Considering that *ACR* is one of the highest impact review journals published, this is not surprising. Most *ACR* papers provide a concise overview with a good historical orientation. While the journal covers research developments, its editorial policy emphasizes intelligibility to nonexperts. Consistent with a modern trend in reviews, most papers do not exceed six published pages. However, such a page limit is unusual for traditional review journals, where articles tend to be much longer.

*Analytical Chemistry* and *Angewandte Chemie—International Edition in English* each accounted for five papers, with the latter having the first and fifth most-cited ones. Since *Angewandte Chemie* is published in both German- and English-language editions, we unified citations to both versions. (This was also done for the Soviet journal *Pis'ma v Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki* and its English translation, *JETP Letters*.) *Inorganic Chemistry*, the *Journal of Chemical Physics*, and the *Journal of Physical Chemistry* each had four papers. The number of papers from these journals is about as expected, except *Inorganic Chemistry* did not appear in the previous list.

## Geographic and Institutional Affiliations

Seventy-one papers in this study have US institutional addresses, while the FRG ranks second with 11. These figures have not changed much over the years (suggesting a steady output of important chemistry-oriented research), although the number of US papers has increased by five over last year's tally. Eight UK papers appear in the Bibliography, followed by four each from Japan and Switzerland, three each from Canada and the USSR, two from Italy, and one each from Australia, France, Israel, and The Netherlands. These data have not changed significantly from previous studies. Data on institutional affiliations can be examined in Table 2.

Of the 41 unique journals represented in this study, those published outside the US include 2 from the FRG, 8 from the UK, and 1 each from Switzerland, Canada, Japan, Denmark, The Netherlands, and the USSR. Twenty-five of the journals were published in the US. However, most of these journals are today considered international.

The authors in the Bibliography are affiliated with 83 institutions. The four most frequently occurring are, in descending order: the University of California (represented by five campuses) with 13; the Argonne National Laboratory, Illinois, as well as the University of Texas, Austin, each with 5; and Caltech, Pasadena, with 4. It should be said that the University of California has been represented in the top three institutions in all our previous annual chemistry-paper studies.

**Table 2: National locations of the institutional affiliations** listed by authors in the Bibliography, according to total appearances (column A). B = number of papers coauthored with researchers affiliated with institutions in other countries. C = national locations of institutions listed by coauthors.

| Country | A | B | C |
|---|---|---|---|
| US | 71 | 8 | Canada, FRG, France, Italy, UK |
| FRG | 11 | 4 | Israel, Switzerland, US |
| UK | 8 | 2 | Australia, US |
| Japan | 4 | 0 | |
| Switzerland | 4 | 1 | FRG |
| Canada | 3 | 2 | US |
| USSR | 3 | 0 | |
| Italy | 2 | 2 | US |
| Australia | 1 | 1 | UK |
| France | 1 | 1 | US |
| Israel | 1 | 1 | FRG |
| The Netherlands | 1 | 0 | |

## Citation Data for Bibliography Papers

The average paper was cited 49.2 times during the three-year period 1984-1986 (the median was 40.5). This included 3.7 cites for 1984; 19.8, for 1985; and 25.7, for 1986. As shown before, the impact of chemistry papers is hardly felt in the first year. Citations increase from year to year and usually peak in the third year after publication—rather than in the second year as in the life sciences and high-energy physics. Note, however, that for over one-third of the papers, citations *increased* in 1987. It is natural for journalists to speak about "hot" papers as those published in the last year or so. However, science doesn't work in exactly the same way as other human affairs. Disc jockeys may be able to promote the hot tunes of the week, but it ordinarily takes more fundamental changes and time to cause dozens of researchers throughout the world to test new ideas or technologies.

Of the 98 papers listed, 76 are core documents in ISI® research fronts; 1 is core to a 1984 front, 45 are core to 1985 fronts, 63 are core to 1986 fronts, and 58 are core to 1987 fronts. I am often asked about the significance of those papers that are *not* identified as core to any research front. This does not mean these papers are not seminal. It may be due simply to the lack of co-citation with other core papers and the way we cluster them.

If we examine the papers cited by those "noncore" but well-cited 1984 papers, we can identify the research fronts to which they are primarily connected. This is done by accessing the ISI database, for example, on Data-Star. Thus, any of the 1984 papers not identified as "core" are connected to several fronts through their normal citation patterns. For example, the paper by Michael J.S. Dewar, Department of Chemistry, University of Texas, Austin, entitled "Multibond reactions cannot normally be synchronous," would be associated with research front #84-0805, "1,3-dipolar cycloaddition reactions and Diels-Alder reactions of nitrogen-containing compounds." Since the average chemistry paper cites over 25 papers, there are that many opportunities for the paper to be linked to that many of the research fronts in our database.

## Authorship

There are 266 unique authors for the 98 papers listed in the Bibliography, although there are 287 author appearances—indicating there are authors with more than 1 paper in this study. There is 1 author with three papers (Dewar) and 16 authors with two publications, with most being secondary authors. Only five are first authors on both of their papers: Roger Atkinson, Statewide Air Pollution Research Center, University of California, Riverside; Alan H. Cowley, Department of Chemistry, University of Texas, Austin; John R. Miller, Argonne National Laboratory; Manfred T. Reetz, Department of Chemistry, University of Marburg, FRG; and Jack M. Williams, Argonne National Laboratory. There is an average of 2.9 authors per paper. Table 3 lists data on the number of authors per paper.

**Table 3:** The number of authors per paper for the 1984 chemistry articles most cited in the *SCI*®, 1984-1986.

| Number of Authors per Paper | Number of Papers |
|---|---|
| 10 | 1 |
| 8 | 3 |
| 6 | 5 |
| 5 | 10 |
| 4 | 9 |
| 3 | 18 |
| 2 | 31 |
| 1 | 21 |

## Research-Front Highlights

Examining the research fronts to which the 1984 most-cited chemistry papers are core reveals that several concern the topic of organic superconductors (fundamentally a physics concept), including three of the fronts listed in Table 4. These three fronts contain the highest number of core papers from the Bibliography (#85-2068, #86-2094, and #87-2095). One of the papers, authored by V.F. Kaminskii and colleagues, Institute of Chemical Physics, Academy of Sciences of the USSR, Moscow, appeared in the well-known Soviet physics journal *Pis'ma v Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki* (*JETP Letters*)—illustrating how the demarcation between physics and chemistry is, at times, quite nebulous. This is most apparent in fields like chemical physics/physical chemistry.[4] Similarly, an essentially mathematical term—fractals (self-similar geometrical objects)—is the topic of two papers, one by David Avnir and Dina Farin, Department of Organic Chemistry, Hebrew University of Jerusalem, Israel, and Peter Pfeifer, Faculty of Chemistry, Bielefeld University, FRG; the other is by J. Klafter, Exxon Research and Engineering Company, Annandale, New Jersey, and A. Blumen, Department of Theoretical Chemistry, Munich Technical University, FRG.

Another topic that appears with some frequency in the Bibliography is intramolecular Diels-Alder reactions. In fact, two research fronts in Table 4—#86-0803 and #87-2376—explicitly involve these reactions, which were named after German chemists Otto Diels (1876-1954) and Kurt Alder (1902-1958). In these reactions, molecules containing alternate double and single bonds react with a compound containing a double bond, resulting in a new compound containing a cyclohexene ring.

As specialized and technical as these papers may be, there are those whose titles might have some appeal to laypersons and the press. For example, a paper by Atkinson, mentioned earlier, and Alan C. Lloyd, Environmental Research & Technology, Inc., Newbury Park, California, concerns "Evaluation of kinetic and mechanistic data for modeling of photochemical smog." Published in the *Journal of Physical and Chemical Reference Data*, it is a "critical evaluation of the rate constants, mechanisms, and products of selected atmospheric reactions of hydrocarbons, nitrogen oxides, and sulfur oxides in air." Such data collections and reviews are vital to finding long-range solutions to complex environmental problems.

Another paper published in an ACS journal, *Environmental Science & Technology*, concerns "High-resolution PCB analysis: synthesis and chromatographic properties of all 209 PCB congeners." This methods and analysis paper was coauthored by Michael

**Table 4: The 1985, 1986, and 1987 ISI® research fronts** that include at least three of the 1984 chemistry papers as core documents. A=number of Bibliography papers that are core to each research front. B=total number of core documents. C=total number of citing papers published for the year designated by the prefix.

| Number | Name | A | B | C |
|---|---|---|---|---|
| 85-2068 | Structure, properties, and design of organic conductors and superconductors | 5 | 27 | 203 |
| 86-0803 | Intramolecular Diels-Alder cyclo-addition, organic synthesis utilizing chiral sulfoxides, and partially regio-controlled photochemical deconjugation | 3 | 53 | 450 |
| 86-0866 | Flow-injection systems, electrochemical pre-treatment at high negative potentials, and stearic-acid modified carbon paste electrodes | 3 | 48 | 399 |
| 86-2094 | Organic conductors, superconducting BEDT-TTF salts, and band electronic structures | 7 | 45 | 293 |
| 86-3340 | Long-range electron transfer, intervalence transfer electronic absorption band of binuclear mixed valence complexes, and bell-shaped energy-gap dependence | 4 | 37 | 472 |
| 87-2095 | High-$T_c$ superconducting state of $\beta$-$(BEDT\text{-}TTF)_2I_3$, molecular conductors, BEDT-TTF charge-transfer salts, band electronic structures, and ambient pressure | 6 | 41 | 260 |
| 87-2376 | Intramolecular Diels-Alder reaction, Lewis acid-catalyzed ene addition, and chiral isoprenyl ethers | 3 | 13 | 125 |
| 87-3659 | Electron-transfer rates, charge separation in the vesicular system, and solvent reorganization dynamics | 5 | 17 | 305 |

D. Mullin, Large Lakes Research Station, US Environmental Protection Agency, Grosse Ile, Michigan, and colleagues. Summarizing this study of polychlorobiphenyls, the authors state that the "synthesis and chromatographic properties of all 209 PCB congeners will lead to a more comprehensive understanding of the ecodynamics of PCBs in the environment. This work, coupled with the identification of the more toxic PCB components..., will permit a more rational assessment of the environmental and human health effects of these compounds since it will now be possible to quantitate the major toxic PCB congeners which bioconcentrate in wildlife and human tissues." In connection with these papers with immediate interest to laypersons, I hope to compile a "Press Citation Index" to determine how many papers have caught the attention of those communicating science to the public.

## Most-Cited Papers

### *Stone/Isolobal Chemistry*

F. Gordon A. Stone, Department of Inorganic Chemistry, University of Bristol, UK, authored the most-cited paper. Entitled "Metal-carbon and metal-metal multiple bonds as ligands in transition-metal chemistry: the isolobal connection," the work received 108 citations between 1984 and 1986. Transition metals are the class of elements on the periodic table characterized by an incomplete inner shell of electrons; these metals have good electrical and thermal conductivity. The term "isolobal" was introduced in the 1970s by a group under the direction of Nobelist (chemistry, 1981) Roald Hoffmann, Cornell University, Ithaca, New York. Two molecular fragments (such as $CH_3$ and $Mn(CO)_5$) are said to be isolobal if the number, symmetry properties, approximate energy, and shape of their outermost orbitals are similar.[5] The Bibliography also lists 1987 cites as well.

A paper that straddles the boundaries of organic and inorganic chemistry ("organometallic chemistry"), Stone's work discusses how a "new domain for synthesis has developed following recognition that the metal-carbon and metal-metal multiple bonds present in certain low-valent transition-metal complexes are reactive centers for the attachment of metal-ligand fragments." This work relates the outer electron orbital shells of organic groups to those of metal-ligand fragments, based on the work of Hoffmann.[6] Indeed, it is also connected to the 1987 Nobel Prize in chemistry, which was awarded for work concerning the linking structures of the cryptate family of molecules.[3]

*Lias, Liebman, and Levin/Gas-Phase Molecules*

The second most-cited 1984 chemistry paper, a 113-page data review, is entitled "Evaluated gas phase basicities and proton affinities of molecules; heats of formation of protonated molecules." This work appeared in the *Journal of Physical and Chemical Reference Data*. Coauthored by Sharon G. Lias and Rhoda D. Levin, Center for Chemical Physics, National Bureau of Standards, Gaithersburg, Maryland, and Joel F. Liebman, Department of Chemistry, University of Maryland Baltimore County, Catonsville, the paper compiles and evaluates the available data on the intrinsic acid-base properties of molecules in the gas phase, that is, in the absence of solvent. Tables of the molecules, ordered according to proton affinity as well as empirical formula, also include listings of the heats of formation of the molecules and the corresponding protonated species. Lias gives her thoughts on why the paper is referred to so often:

> When experiments permitting the measurement of these particular molecular properties (of considerable interest to organic chemists) became possible in the early 1970s, there was quite a lot of activity and data were generated in many laboratories. Unfortunately, the experimental results were normalized in different ways by different researchers, so it was difficult to compare results or use data on two different molecules generated in different places. The significance of our paper is that we pulled together all the data and put them onto an internally consistent scale. I think that this is why...it has become the single authoritative source for all these data.[7]

In the first three years after its publication, the paper was cited in 105 publications. Also cited in 57 new papers in 1987, this review is well on its way to *Citation Classic*® status.

*Heinrikson and Meredith/Amino-Acid Chromatography*

Ordinarily, a paper published in *Analytical Biochemistry* would turn up in a list of most-cited life-sciences articles. However, the third most-cited paper, "Amino acid analysis by reverse-phase high-performance liquid chromatography: precolumn derivatization with phenylisothiocyanate," has been cited outside of biochemistry journals, and so turns up in this chemistry study. Authored by Heinrikson and Meredith, mentioned earlier, the paper delineates the procedures and methods for the "quantitative derivatization of amino acids...and for the separation and quantitation of the resulting...derivatives by reverse-phase high-performance liquid chromatography." This paper discusses separation chemistry techniques but involves primarily protein chemistry (an area more oriented towards the life sciences). From 1984 through 1986 it was listed as a reference in 104 different articles.

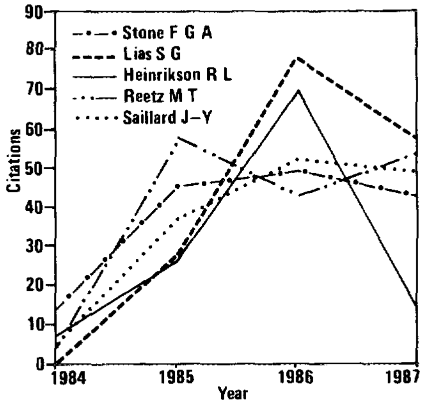
*Reetz/Chiral-Compound Chemistry*

The fourth most-cited chemistry paper, with over 100 explicit citations, is entitled "Chelation or non-chelation control in addition reactions of chiral $\alpha$- and $\beta$-alkoxy carbonyl compounds." Authored by Reetz, mentioned earlier, this work can be considered a mini-review paper on a new synthetic method of making mirror-image pairs of molecules. This was accomplished by controlling chelation (the predisposition to join into a ring-like structure) while adding chemical species that donate electrons, as well as by a process that did not control chelation. This research is related to the work of Nobelists Donald J. Cram (chemistry, 1987), University of California, Los Angeles, and Hoffmann, both of whom were subjects of recent essays.[3,6]

*Saillard and Hoffmann/Carbon-Hydrogen Activation*

Speaking of Hoffmann, he appears with Jean-Yves Saillard, also of Cornell, as coauthor of the fifth most-cited work in this study. Hoffmann is well known in the subfield of organometallics known as C-H activation, which is the breaking of carbon-hydrogen bonds in organic compounds. Entitled "C-H and H-H activation in transition metal complexes and on surfaces," this paper has been referenced in over 90 different publications through 1986. According to the authors, the paper informs the reader "how an H-H [hydrogen-hydrogen] or C-H [carbon-hydrogen] bond can interact and eventually break in the proximity of one or more transition-metal centers.... The most interesting aspect of our study [is] the comparison of similarities and differences between the chemistry that goes on in an inorganic complex and on a metal surface." Figure 1 is a graphic display of year-by-year citations to the five most-cited chemistry papers.

**Figure 1: Most-cited 1984 chemistry papers.** Year-by-year citations to the five 1984 chemistry papers most cited in the *SCI*®, 1984-1986. Papers shown are Stone F G A. *Angew. Chem. Int. Ed.* 23:89-99, 1984; Lias S G. *J. Phys. Chem. Ref. Data* 13:695-808, 1984; Heinrikson R L. *Anal. Biochem.* 136:65-74, 1984; Reetz M T. *Angew. Chem. Int. Ed.* 23:556-69, 1984; and Saillard J-Y. *J. Amer. Chem. Soc.* 106:2006-26, 1984.




## Conclusion

In concluding this study of highly cited 1984 chemistry papers, it is worth noting that there has been a 40 percent increase in the number of review papers. In 1984 36 reviews turned up. However, examining previous years shows that there is not a consistent trend—21 review papers in 1981; 54, in 1982; and about 25, in 1983. Nevertheless, over the four-year period, about 30 percent of the papers turned out to be reviews. It would be interesting to learn whether reviews are growing at a faster rate than the literature itself.

Science watchers are always interested in knowing what is "hot" in science. To help you follow areas of heightened activity you can scan the "Hot Papers" listing in each issue of ISI's newspaper, *THE SCIENTIST*®. Every two months, we search the *SCI* database and look for papers that are cited beyond the rate typical for a given category of articles. However, chemistry, as we have seen above, is apt to be shortchanged in any analysis of the most current year's output. It is more characteristic to observe that trends in chemistry warm up gradually over several years. It may be difficult for the average citizen to understand why a 1984 paper is now considered "hot." But there is a long incubation process in communicating science, particularly in chemistry and other fields, such as the earth sciences.

Scientists, it might be said, live in a kind of time warp. Their ideas are based on a complex structure of theories, methods, and so on. They are exposed to hundreds, if not thousands, of novel ideas in the course of a year—far too many for even the most prodigious memory to keep track of. Mere lists of outstanding papers represent a good sample of the excellent work done in chemistry each year, but no matter what method you choose—quantitative citation analysis or qualitative peer review—some significant work will not yet be accounted for. It would be a dull world, indeed, if every pioneer were recognized in his youth, no less in his lifetime. But those who are sensitive to the limitations of human judgment keep working towards the preferred goal of early recognition of merit.

* * * * *

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## REFERENCES

1. **Garfield E.** The 1980 chemistry articles most cited in 1980-1982. *Essays of an information scientist.* Philadelphia: ISI Press, 1984. Vol. 6. p. 276-86. (Reprinted from: *Current Contents* (35):5-15, 29 August 1983.)
2. ————. The 1987 Nobel Prize in physics: citations to K.A. Müller and J.G. Bednorz's seminal work mirror developments in superconductivity. *Current Contents* (18):3-11, 2 May 1988.
3. ————. Work on molecules that mimic biological processes leads to 1987 Nobel Prize in chemistry for Jean-Marie Lehn, Charles J. Pedersen, and Donald J. Cram. *Current Contents* (15):3-9, 11 April 1988.
4. ————. The 1981 most-cited chemistry papers. Part 2. Highlighting the arbitrary boundaries between chemistry and physics. *Essays of an information scientist: ghostwriting and other essays.* Philadelphia: ISI Press, 1986. Vol. 8. p. 327-38.
5. **Hoffmann R.** Personal communication. 4 August 1988.
6. **Garfield E.** Were the 1981 Nobel prizewinners in science, economics, and literature anticipated by citation analysis? *Op. cit.*, 1983. Vol. 5. p. 551-61.
7. **Lias S G.** Personal communication. 12 August 1988.


## BIBLIOGRAPHY

**The 1984 chemistry articles most cited in the *SCI*®, 1984-1986.** Articles are listed in alphabetic order by first author. Numbers following the bibliographic entry indicate the 1984, 1985, 1986, and 1987 *SCI/SSCI*® research-front specialties for which these are core papers. A=number of 1984 citations. B=number of 1985 citations. C=number of 1986 citations. D=total number of 1984-1986 citations. E=number of 1987 citations.

| A | B | C | D | Bibliographic Data | E |
|---|---|---|---|---|---|
| 0 | 12 | 28 | 40 | **Armstrong D W & DeMond W.** Cyclodextrin bonded phases for the liquid chromatographic separation of optical, geometrical, and structural isomers. *J. Chromatogr. Sci.* 22:411-5, 1984. 86-1133, 87-0612 | 18 |
| 5 | 12 | 24 | 41 | **Armstrong W H, Spool A, Papaefthymiou G C, Frankel R B & Lippard S J.** Assembly and characterization of an accurate model for the diiron center in hemerythrin. *J. Amer. Chem. Soc.* 106:3653-67, 1984. 86-1138, 87-1153 | 27 |
| 1 | 21 | 25 | 47 | **Atkinson R & Lloyd A C.** Evaluation of kinetic and mechanistic data for modeling of photochemical smog. *J. Phys. Chem. Ref. Data* 13:315-44, 1984. 85-0398, 86-1317, 87-1336 | 26 |
| 10 | 12 | 15 | 37 | **Atkinson R, Plum C N, Carter W P L, Winer A M & Pitts J N.** Rate constants for the gas-phase reactions of nitrate radicals with a series of organics in air at 298± 1 K. *J. Phys. Chem.* 88:1210-5, 1984. | 8 |
| 8 | 27 | 20 | 55 | **Avnir D, Farin D & Pfeifer P.** Molecular fractal surfaces. *Nature* 308:261-3, 1984. 85-0505, 86-1385, 87-1405 | 24 |
| 0 | 10 | 26 | 36 | **Bender K, Hennig I, Schweitzer D, Dietz K, Endres H & Keller H J.** Synthesis, structure and physical properties of a two-dimensional organic metal, di[bis(ethylenedithiolo)tetrathiofulvalene] triiodide, $(BEDT\text{-}TTF)_2{}^+I_3{}^-$. *Mol. Cryst. Liquid Cryst.* 108:359-71, 1984. 86-2094, 87-2095 | 18 |
| 6 | 13 | 17 | 36 | **Beratan D N & Hopfield J J.** Calculation of electron tunneling matrix elements in rigid systems: mixed-valence dithiaspirocyclobutane. *J. Amer. Chem. Soc.* 106:1584-94, 1984. | 13 |
| 0 | 10 | 69 | 79 | **Bidlingmeyer B A, Cohen S A & Tarvin T L.** Rapid analysis of amino acids using pre-column derivatization. *J. Chromatogr.* 336:93-104, 1984. 86-2517 | 115 |
| 4 | 44 | 25 | 73 | **Bohlmann F, Zdero C, King R M & Robinson H.** Pseudoguaianolides and other sesquiterpene lactones from *Gaillardia* species. *Phytochemistry* 23:1979-88, 1984. 85-2843, 87-2885 | 31 |
| 2 | 12 | 26 | 40 | **Bond A M, Fleischmann M & Robinson J.** Electrochemistry in organic solvents without supporting electrolyte using platinum microelectrodes. *J. Electroanal. Chem. Interfac.* 168:299-312, 1984. 86-0866, 87-1030 | 27 |
| 3 | 19 | 29 | 51 | **Brady R M & Ball R C.** Fractal growth of copper electrodeposits. *Nature* 309:225-9, 1984. | 20 |
| 5 | 15 | 16 | 36 | **Buttry D A & Anson F C.** New strategies for electrocatalysis at polymer-coated electrodes. Reduction of dioxygen by cobalt porphyrins immobilized in nafion coatings on graphite electrodes. *J. Amer. Chem. Soc.* 106:59-64, 1984. 86-0462 | 10 |
| 6 | 18 | 16 | 40 | **Chandrasekhar J, Smith S F & Jorgensen W L.** $S_N2$ reaction profiles in the gas phase and aqueous solution. *J. Amer. Chem. Soc.* 106:3049-50, 1984. | 10 |

| A | B | C | D | Bibliographic Data | E |
|---|---|---|---|---|---|
| 2 | 25 | 25 | 52 | **Chang R K & Laube B L.** Surface-enhanced Raman scattering and nonlinear optics applied to electrochemistry. *CRC Crit. Rev. Sol. St. Mat. Sci.* 12:1-73, 1984. 85-1723, 86-3956, 87-0193 | 22 |
| 7 | 18 | 19 | 44 | **Chisholm M H, Folting K, Huffman J C & Kirkpatrick C C.** Reactions of metal-metal multiple bonds. 10. Reactions of $Mo_2(OR)_6$ ($M \equiv M$) and $[Mo(OR)_4]_x$ compounds with molecular oxygen. Preparation and characterization of oxo alkoxides of molybdenum: $MoO_2(OR)_2$, $MoO_2(OR)_2(bpy)$, $MoO(OR)_4$, $Mo_3O(OR)_{10}$, $Mo_4O_8(OR)_4(py)_4$, and $Mo_6O_{10}(OR)_{12}$. *Inorg. Chem.* 23:1021-37, 1984. 85-1816, 86-1268, 87-4038 | 30 |
| 1 | 16 | 17 | 34 | **Churchill M R, Ziller J W, Freudenberger J H & Schrock R R.** Metathesis of acetylenes by triphenoxytungstenacyclobutadiene complexes and the crystal structure of $W(C_3Et_3)[O\text{-}2,6\text{-}C_6H_3(i\text{-}Pr)_2]_3$.*Organometallics* 3:1554-62, 1984. 86-4123 | 11 |
| 0 | 22 | 31 | 53 | **Ciganek E.** The intramolecular Diels-Alder reaction. *Organic Reactions* 32:1-374, 1984. 85-2466, 86-0803, 87-2376 | 29 |
| 0 | 18 | 17 | 35 | **Collman J P, Brauman J I, Meunier B, Raybuck S A & Kodadek T.** Epoxidation of olefins by cytochrome P-450 model compounds: mechanism of oxygen atom transfer. *Proc. Nat. Acad. Sci. USA* 81:3245-8, 1984. | 8 |
| 5 | 24 | 14 | 43 | **Corey E J & Gross A W.** Highly selective, kinetically controlled enolate formation using lithium dialkylamides in the presence of trimethylchlorosilane. *Tetrahedron Lett.* 25:495-8, 1984. 85-2259, 86-0376 | 14 |
| 5 | 25 | 37 | 67 | **Cowley A H.** Double bonding between the heavier main-group elements: from reactive intermediates to isolable molecules. *Polyhedron* 3:389-432, 1984. 85-4406, 86-1903, 87-1045 | 40 |
| 0 | 16 | 22 | 38 | **Cowley A H.** Stable compounds with double bonding between the heavier main-group elements. *Account. Chem. Res.* 17:386-92, 1984. 85-4406, 86-1903, 87-1045 | 26 |
| 2 | 20 | 12 | 34 | **Dewar M J S.** Chemical implications of $\sigma$ conjugation. *J. Amer. Chem. Soc.* 106:669-82, 1984. 87-1645 | 15 |
| 14 | 33 | 25 | 72 | **Dewar M J S.** Multibond reactions cannot normally be synchronous. *J. Amer. Chem. Soc.* 106:209-19, 1984. | 33 |
| 7 | 13 | 13 | 33 | **Dewar M J S & Pierini A B.** Mechanism of the Diels-Alder reaction. Studies of the addition of maleic anhydride to furan and methylfurans. *J. Amer. Chem. Soc.* 106:203-8, 1984. | 12 |
| 3 | 17 | 17 | 37 | **Dill K A, Koppel D E, Cantor R S, Dill J D, Bendedouch D & Chen S-H.** Molecular conformations in surfactant micelles. *Nature* 309:42-5, 1984. 85-2211 | 6 |
| 3 | 15 | 15 | 33 | **Engstrom R C & Strasser V A.** Characterization of electrochemically pretreated glassy carbon electrodes. *Anal. Chem.* 56:136-41, 1984. 85-2639, 86-0866, 87-3624 | 15 |
| 4 | 17 | 26 | 47 | **Erker G.** Carbonylation of zirconocene complexes. *Account. Chem. Res.* 17:103-9, 1984. | 18 |
| 14 | 30 | 30 | 74 | **Fallis A G.** The intramolecular Diels-Alder reaction: recent advances and synthetic applications. *Can. J. Chem.* 62:183-234, 1984. 85-2466, 86-0803, 87-2376 | 26 |
| 7 | 22 | 12 | 41 | **Fendler J H & Tundo P.** Polymerized surfactant aggregates: characterization and utilization. *Account. Chem. Res.* 17:3-8, 1984. 86-0046, 87-2123 | 16 |
| 5 | 13 | 18 | 36 | **Fjeldsted J C & Lee M L.** Capillary supercritical fluid chromatography. *Anal. Chem.* 56:A619-28, 1984. 86-1885 | 12 |
| 6 | 25 | 26 | 57 | **Friedrich J & Haarer D.** Photochemical hole burning: a spectroscopic study of relaxation processes in polymers and glasses. *Angew. Chem. Int. Ed.* 23:113-40, 1984. 85-3524, 86-2626, 87-0887 | 39 |
| 5 | 36 | 45 | 86 | **Frisch M J, Pople J A & Binkley J S.** Self-consistent molecular orbital methods 25. Supplementary functions for Gaussian basis sets. *J. Chem. Phys.* 80:3265-9, 1984. 85-1878, 86-1816, 87-1889 | 39 |
| 5 | 16 | 29 | 50 | **Gilmore C J.** *MITHRIL*—an integrated direct-methods computer program. *J. Appl. Cryst.* 17:42-6, 1984. 84-0029, 86-2955, 87-6028 | 44 |
| 1 | 10 | 22 | 33 | **Goodman D W.** Model catalytic studies over metal single crystals. *Account. Chem. Res.* 17:194-200, 1984. 85-0901 | 12 |
| 1 | 21 | 18 | 40 | **Gross M L & Rempel D L.** Fourier transform mass spectrometry. *Science* 226:261-8, 1984. 86-0065, 87-0076 | 25 |
| 2 | 15 | 17 | 34 | **Groves J T & Subramanian D V.** Hydroxylation by cytochrome P-450 and metalloporphyrin models. Evidence for allylic rearrangement. *J. Amer. Chem. Soc.* 106:2177-81, 1984. | 8 |
| 1 | 13 | 25 | 39 | **Gudeman C S & Saykally R J.** Velocity modulation infrared laser spectroscopy of molecular ions. *Annu. Rev. Phys. Chem.* 35:387-418, 1984. 86-6192, 87-3778 | 17 |

| A | B | C | D | Bibliographic Data | E |
|---|---|---|---|---|---|
| 10 | 15 | 11 | 36 | **Haese N N & Oka T.** Observation of the $\nu_2(1^- \leftarrow 0^+)$ inversion mode band in $H_3O^+$ by high resolution infrared spectroscopy. *J. Chem. Phys.* 80:572-3, 1984. | 4 |
| 3 | 17 | 25 | 45 | **Hart D J.** Free-radical carbon-carbon bond formation in organic synthesis. *Science* 223:883-7, 1984. 86-0051, 87-1896 | 34 |
| 7 | 26 | 71 | 104 | **Heinrikson R L & Meredith S C.** Amino acid analysis by reverse-phase high-performance liquid chromatography: precolumn derivatization with phenylisothiocyanate. *Anal. Biochem.* 136:65-74, 1984. | 12 |
| 2 | 27 | 29 | 58 | **Hoffmann F M & de Paola R A.** Anomalous C-O bond weakening of side-on-bonded carbon monoxide on a potassium-promoted Ru(001) surface. *Phys. Rev. Lett.* 52:1697-700, 1984. | 19 |
| 0 | 13 | 22 | 35 | **Horwitz C P & Shriver D F.** C- and O-bonded metal carbonyls: formation, structures, and reactions. *Advan. Organometal. Chem.* 23:219-305, 1984. 87-4660 | 24 |
| 4 | 19 | 36 | 59 | **Howell J O & Wightman R M.** Ultrafast voltammetry and voltammetry in highly resistive solutions with microvoltammetric electrodes. *Anal. Chem.* 56:524-9, 1984. 86-0866, 87-1030 | 26 |
| 6 | 19 | 17 | 42 | **Isied S S, Kuehn C & Worosila G.** Ruthenium-modified cytochrome *c*: temperature dependence of the rate of intramolecular electron transfer. *J. Amer. Chem. Soc.* 106:1722-6, 1984. 85-4276 | 14 |
| 1 | 28 | 28 | 57 | **Jones W D & Feher F J.** The mechanism and thermodynamics of alkane and arene carbon-hydrogen bond activation in $(C_5Me_5)Rh(PMe_3)(R)H$. *J. Amer. Chem. Soc.* 106:1650-63, 1984. 85-1641, 87-2374 | 33 |
| 12 | 38 | 27 | 77 | **Kaminskii V F, Prokhorova T G, Shibaeva R P & Yagubskii E B.** Crystal structure of the organic superconductor $(BEDT\text{-}TTF)_2I_3$. *JETP Lett.—Engl. Tr.* 39:17-20, 1984. (Translated from *Pisma Zh. Eksp. Teor. Fiz.* 39:15-8, 1984.) 85-2068, 86-2094 | 17 |
| 1 | 18 | 21 | 40 | **Keepers J W & James T L.** A theoretical study of distance determinations from NMR. Two-dimensional nuclear Overhauser effect spectra. *J. Magn. Resonance* 57:404-26, 1984. 86-1343, 87-1356 | 25 |
| 5 | 21 | 32 | 58 | **Kessler H, Griesinger C, Zarbock J & Loosli H R.** Assignment of carbonyl carbons and sequence analysis in peptides by heteronuclear shift correlation via small coupling constants with broadband decoupling in $t_1$ (COLOC). *J. Magn. Resonance* 57:331-6, 1984. 85-1361, 86-6332, 87-2916 | 45 |
| 11 | 12 | 13 | 36 | **Klafter J & Blumen A.** Fractal behavior in trapping and reaction. *J. Chem. Phys.* 80:875-7, 1984. | 11 |
| 0 | 9 | 25 | 34 | **Klinowski J.** Nuclear magnetic resonance studies of zeolites. *Prog. Nucl. Magn. Reson. Spectros.* 16:237-309, 1984. 86-0860, 87-2523 | 23 |
| 2 | 30 | 56 | 88 | **Knight W D, Clemenger K, de Heer W A, Saunders W A, Chou M Y & Cohen M L.** Electronic shell structure and abundances of sodium clusters. *Phys. Rev. Lett.* 52:2141-3, 1984. 85-1860, 86-2748, 87-1267 | 41 |
| 6 | 15 | 18 | 39 | **Kobayashi H, Kato R, Mori T, Kobayashi A, Sasaki Y, Saito G, Enoki T & Inokuchi H.** Crystal structures and electrical properties of BEDT-TTF compounds. *Mol. Cryst. Liquid Cryst.* 107:33-43, 1984. 85-2068, 86-2094, 87-2095 | 11 |
| 3 | 11 | 20 | 34 | **Kobayashi T, Yoneyama H & Tamura H.** Polyaniline film-coated electrodes as electrochromic display devices. *J. Electroanal. Chem. Interfac.* 161:419-23, 1984. 85-1984, 86-1988, 87-3442 | 22 |
| 6 | 18 | 39 | 63 | **Kubas G J, Ryan R R, Swanson B I, Vergamini P J & Wasserman H J.** Characterization of the first examples of isolable molecular hydrogen complexes, $M(CO)_3(PR_3)_2(H_2)$ (M=Mo, W; R=Cy, *i*-Pr). Evidence for a side-on bonded $H_2$ ligand. *J. Amer. Chem. Soc.* 106:451-2, 1984. 86-3302, 87-4349 | 30 |
| 0 | 27 | 78 | 105 | **Lias S G, Liebman J F & Levin R D.** Evaluated gas phase basicities and proton affinities of molecules; heats of formation of protonated molecules. *J. Phys. Chem. Ref. Data* 13:695-808, 1984. 85-7423, 86-4707 | 57 |
| 2 | 19 | 13 | 34 | **Liotta D.** New organoselenium methodology. *Account. Chem. Res.* 17:28-34, 1984. 85-1240, 86-1457, 87-1615 | 15 |
| 4 | 17 | 16 | 37 | **Magi M, Lippmaa E, Samoson A, Engelhardt G & Grimmer A-R.** Solid-state high-resolution silicon-29 chemical shifts in silicates. *J. Phys. Chem.* 88:1518-22, 1984. 85-0926, 86-0860, 87-2523 | 13 |
| 2 | 11 | 25 | 38 | **Mandich M L, Halle L F & Beauchamp J L.** Determination of the metal-hydrogen and metal-methyl bond dissociation energies of the second-row, group 8 transition metal cations. *J. Amer. Chem. Soc.* 106:4403-11, 1984. | 22 |
| 0 | 19 | 19 | 38 | **McGarvey G J, Kimura M, Oh T & Williams J M.** Acyclic stereoselective synthesis of carbohydrates. *J. Carbohyd. Chem.* 3:125-88, 1984. 85-1075, 86-0989 | 16 |

| A | B | C | D | Bibliographic Data | E |
|---|---|---|---|---|---|
| 5 | 19 | 16 | 40 | **Menger F M & Doll D W.** On the structure of micelles. *J. Amer. Chem. Soc.* *106:1109-13, 1984. 85-2211*, 86-0046, 87-4286 | 13 |
| 0 | 14 | 17 | 31 | **Miller J R, Beitz J V & Huddleston R K.** Effect of free energy on rates of electron transfer between molecules. *J. Amer. Chem. Soc.* 106:5057-68, 1984. 86-3340, 87-3659 | 28 |
| 6 | 34 | 47 | 87 | **Miller J R, Calcaterra L T & Closs G L.** Intramolecular long-distance electron transfer in radical anions. The effects of free energy and solvent on the reaction rates. *J. Amer. Chem. Soc.* 106:3047-9, 1984. 85-7680, 86-3340, 87-3659 | 39 |
| 1 | 13 | 29 | 43 | **Mingos D M P.** Polyhedral skeletal electron pair approach. *Account. Chem. Res.* 17:311-9, 1984. 86-2753, 87-3647 | 24 |
| 3 | 18 | 17 | 38 | **Mislow K & Siegel J.** Stereoisomerism and local chirality. *J. Amer. Chem. Soc.* 106:3319-28, 1984. 87-5718 | 18 |
| 2 | 22 | 30 | 54 | **Mori T, Kobayashi A, Sasaki Y, Kobayashi H, Saito G & Inokuchi H.** Band structures of two types of $(BEDT\text{-}TTF)_2I_3$. *Chem. Lett.* 6:957-60, 1984. 85-2068, 86-2094, 87-2095 | 20 |
| 0 | 19 | 21 | 40 | **Mullin M D, Pochini C M, McCrindle S, Romkes M, Safe S H & Safe L M.** High-resolution PCB analysis: synthesis and chromatographic properties of all 209 PCB congeners. *Environ. Sci. Technol.* 18:468-76, 1984. 85-0453, 86-1324, 87-1641 | 19 |
| 1 | 8 | 33 | 42 | **Newton M D & Sutin N.** Electron transfer reactions in condensed phases. *Annu. Rev. Phys. Chem.* 35:437-80, 1984. 86-3340, 87-3659 | 34 |
| 1 | 18 | 16 | 35 | **Niki E, Saito T, Kawakami A & Kamiya Y.** Inhibition of oxidation methyl linoleate in solution by vitamin E and vitamin C. *J. Biol. Chem.* 259:4177-82, 1984. 85-2933 | 15 |
| 2 | 19 | 21 | 42 | **Nocera D G, Winkler J R, Yocom K M, Bordignon E & Gray H B.** Kinetics of intramolecular electron transfer from $Ru^{II}$ to $Fe^{III}$ in ruthenium-modified cytochrome *c*. *J. Amer. Chem. Soc.* 106:5145-50, 1984. 85-4276, 86-3340, 87-3659 | 22 |
| 0 | 36 | 38 | 74 | **Oppolzer W.** Asymmetric Diels-Alder and ene reactions in organic synthesis. *Angew. Chem. Int. Ed.* 23:876-89, 1984. 85-4350, 86-0803, 87-2376 | 31 |
| 6 | 21 | 24 | 51 | **Powell M F, Pai E F & Bruice T C.** Study of (tetraphenylporphinato)manganese(III)-catalyzed epoxidation and demethylation using *p*-cyano-*N,N*-dimethylaniline *N*-oxide as oxygen donor in a homogeneous system. Kinetics, radiochemical ligation studies, and reaction mechanism for a model of cytochrome P-450. *J. Amer. Chem. Soc.* 106:3277-85, 1984. 86-2452 | 13 |
| 4 | 55 | 42 | 101 | **Reetz M T.** Chelation or non-chelation control in addition reactions of chiral α- and β-alkoxy carbonyl compounds. *Angew. Chem. Int. Ed.* 23:556-69, 1984. 85-0967, 86-0989, 87-2870 | 53 |
| 12 | 17 | 11 | 40 | **Reetz M T, Kesseler K & Jung A.** Concerning the role of Lewis acids in chelation controlled addition to chiral alkoxy aldehydes. *Tetrahedron Lett.* 25:729-32, 1984. | 5 |
| 3 | 13 | 17 | 33 | **Rossetti R, Ellison J L, Gibson J M & Brus L E.** Size effects in the excited electronic states of small colloidal CdS crystallites. *J. Chem. Phys.* 80:4464-9, 1984. 86-3417 | 18 |
| 4 | 36 | 51 | 91 | **Saillard J-Y & Hoffmann R.** C-H and H-H activation in transition metal complexes and on surfaces. *J. Amer. Chem. Soc.* 106:2006-26, 1984. 85-1641, 86-3302, 87-4349 | 48 |
| 4 | 23 | 22 | 49 | **Scheek R M, Boelens R, Russo N, van Boom J H & Kaptein R.** Sequential resonance assignments in $^1H$ NMR spectra of oligonucleotides by two-dimensional NMR spectroscopy. *Biochemistry—USA* 23:1371-6, 1984. | 20 |
| 5 | 20 | 22 | 47 | **Schleyer P v R.** Remarkable structures of lithium compounds. *Pure Appl. Chem.* 56:151-62, 1984. 85-8228, 86-1816, 87-1820 | 17 |
| 9 | 13 | 24 | 46 | **Schnurrenberger P, Hungerbuhler E & Seebach D.** (+)-colletodiol. Synthesis from (S,S)-tartaric acid and (R)-3-hydroxy-butyric acid. *Tetrahedron Lett.* 25:2209-12, 1984. | 2 |
| 9 | 18 | 16 | 43 | **Seitz W R.** Chemical sensors based on fiber optics. *Anal. Chem.* 56:A16-34, 1984. 85-0043, 86-7134, 87-5950 | 21 |
| 0 | 16 | 21 | 37 | **Shibaev V P & Plate N A.** Thermotropic liquid-crystalline polymers with mesogenic side groups. *Advan. Polym. Sci.* 60:173-252, 1984. 85-0649, 86-1022, 87-1037 | 24 |
| 3 | 17 | 29 | 49 | **Simoens A J, Baker R T K, Dwyer D J, Lund C R F & Madon R J.** A study of the nickel-titanium oxide interaction. *J. Catal.* 86:359-72, 1984. 86-0892 | 17 |
| 1 | 16 | 21 | 38 | **Simons J P.** Photodissociation: a critical survey. *J. Phys. Chem.* 88:1287-93, 1984. 87-0948 | 25 |

| A | B | C | D | Bibliographic Data | E |
|---|---|---|---|---|---|
| 1 | 12 | 22 | 35 | **Smith R D, Kalinoski H T, Udseth H R & Wright B W.** Rapid and efficient capillary column supercritical fluid chromatography with mass spectrometric detection. *Anal. Chem.* 56:2476-80, 1984. 86-1885 | 17 |
| 1 | 14 | 22 | 37 | **Soos Z G & Ramasesha S.** Valence-bond theory of linear Hubbard and Pariser-Parr-Pople models. *Phys. Rev. B—Condensed Matter* 29:5410-22, 1984. 86-6710 | 13 |
| 9 | 13 | 14 | 36 | **Stenkamp R E, Sieker L C & Jensen L H.** Binuclear iron complexes in methemerythrin and azidomethemerythrin at 2.0-Å resolution. *J. Amer. Chem. Soc.* 106:618-22, 1984. | 22 |
| 14 | 45 | 49 | 108 | **Stone F G A.** Metal-carbon and metal-metal multiple bonds as ligands in transition-metal chemistry: the isolobal connection. *Angew. Chem. Int. Ed.* 23:89-99, 1984. 85-0449, 86-6612, 87-0482 | 41 |
| 1 | 14 | 18 | 33 | **Teo B K, Longoni G & Chung F R K.** Applications of topological electron-counting theory to polyhedral metal clusters. *Inorg. Chem.* 23:1257-66, 1984. | 9 |
| 0 | 18 | 24 | 42 | **Traylor P S, Dolphin D & Traylor T G.** Sterically protected hemins with electronegative substituents: efficient catalysts for hydroxylation and epoxidation. *J. Chem. Soc. Commun.* 5:279-80, 1984. 85-0325 | 14 |
| 0 | 18 | 17 | 35 | **Vannice M A & Sudhakar C.** A model for the metal-support effect enhancing CO hydrogenation rates over Pt-$TiO_2$ catalysts. *J. Phys. Chem.* 88:2429-32, 1984. | 24 |
| 3 | 20 | 32 | 55 | **Vollhardt K P C.** Cobalt-mediated [2+2+2]-cycloadditions: a maturing synthetic strategy. *Angew. Chem. Int. Ed.* 23:539-56, 1984. 87-0483 | 22 |
| 1 | 22 | 14 | 37 | **Wasielewski M R & Niemczyk M P.** Photoinduced electron transfer in *meso*-triphenyltriptycenylporphyrin-quinones. Restricting donor-acceptor distances and orientations. *J. Amer. Chem. Soc.* 106:5043-5, 1984. 85-7680, 87-3659 | 13 |
| 2 | 15 | 21 | 38 | **Wax M J, Stryker J M, Buchanan J M, Kovac C A & Bergman R G.** Reversible C-H insertion/reductive elimination in ($\eta^5$-pentamethylcyclopentadienyl)-(trimethylphosphine)-iridium complexes. Use in determining relative metal-carbon bond energies and thermally activating methane. *J. Amer. Chem. Soc.* 106:1121-2, 1984. | 11 |
| 6 | 38 | 53 | 97 | **Weiner S J, Kollman P A, Case D A, Singh U C, Ghio C, Alagona G, Profeta S & Weiner P.** A new force field for molecular mechanical simulation of nucleic acids and proteins. *J. Amer. Chem. Soc.* 106:765-84, 1984. 85-8454, 86-2671, 87-1914 | 60 |
| 2 | 15 | 16 | 33 | **Weinberger B R, Roxlo C B, Etemad S, Baker G L & Orenstein J.** Optical absorption in polyacetylene: a direct measurement using photothermal deflection spectroscopy. *Phys. Rev. Lett.* 53:86-9, 1984. | 9 |
| 6 | 29 | 31 | 66 | **Williams J M, Emge T J, Wang H H, Beno M A, Copps P T, Hall L N, Carlson K D & Crabtree G W.** Synthetic metals based on bis(ethylenedithio)tetrathiafulvalene (BEDT-TTF): synthesis, structure, and ambient-pressure superconductivity in $(BEDT\text{-}TTF)_2I_3$. *Inorg. Chem.* 23:2558-60, 1984. 85-2068, 86-2094, 87-2095 | 18 |
| 0 | 26 | 43 | 69 | **Williams J M, Wang H H, Beno M A, Emge T J, Sowa L M, Copps P T, Behroozi F, Hall L N, Carlson K D & Crabtree G W.** Ambient-pressure superconductivity at 2.7 K and higher temperatures in derivatives of $(BEDT\text{-}TTF)_2IBr_2$: synthesis, structure, and detection of superconductivity. *Inorg. Chem.* 23:3839-41, 1984. 85-2068, 86-2094, 87-2095 | 27 |
| 1 | 13 | 21 | 35 | **Wudl F.** From organic metals to superconductors: managing conduction electrons in organic solids. *Account. Chem. Res.* 17:227-32, 1984. 85-3433, 86-2094, 87-2095 | 25 |
| 1 | 11 | 25 | 37 | **Wuthrich K, Billeter M & Braun W.** Polypeptide secondary structure determination by nuclear magnetic resonance observation of short proton-proton distances. *J. Mol. Biol.* 180:715-40, 1984. 86-1343, 87-1356 | 37 |