K. P. C. Vollhardt

*K. Peter C. Vollhardt has recently published his **10th article** since 2000 in Angewandte Chemie:* "Mechanism of Thermal Reversal of the (Fulvalene)-tetracarbonyldiruthenium Photoisomerization: Toward Molecular Solar–Thermal Energy Storage": Y. Kanai, V. Srinivasan, S. K. Meier, K. P. C. Vollhardt, J. C. Grossman, *Angew. Chem.* **2010**, *122*, 9110–9113; *Angew. Chem. Int. Ed.* **2010**, *49*, 8926–8929.

K. Peter C. Vollhardt

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Education:	1965 Abitur, Luitpold Oberrealschule München (Germany) 1967 Vordiplom, Chemistry, Ludwigs-Maximilians-Universität München 1972 PhD, Organic Chemistry, University College London (UK) 1972–1974 Postdoctoral Fellow with Professor Robert G. Bergman, California Institute of Technology, Pasadena, California (USA)
Awards:	**1983** Adolf Windaus Medal of the Georg-August-Universität Göttingen; **1983** Science Digest "100 Outstanding Young Scientists in America"; **1985** Miller Research Professorship in Residence; **1985** Humboldt Senior Scientist Award; **1987** American Chemical Society Award in Organometallic Chemistry; **1987** Elected Member of the Organic Division Committee of IUPAC; **1990** Otto Bayer Prize; **1991** ACS Arthur C. Cope Scholar Award; **1995** Award of the Japan Society for the Promotion of Science; **1996** Prize of the Stiftung Buchkunst; **1998** National Science Foundation Special Creativity Award; **1999** ACS Edward Leete Award; **2000** Medal of the Université Aix-Marseille; **2004** Honorary Doctorate of the Università degli Studi di Roma "Tor Vergata"
Current research interests:	Synthetic and mechanistic organic and organometallic chemistry for the synthesis of complex natural and unnatural products
Hobbies:	Soccer, skiing, cooking, music, and the pursuit of a parking space

When I wake up I … try to ask a pertinent question of the seminar speaker (quote from Jay Siegel; I can't top that).

The most significant scientific advance of the last 100 years has been … Einstein's discovery that time actually equals money.

The biggest problem that scientists face is … civilians.

The biggest challenge facing scientists is … inertia.

If I won the lottery I would … buy another Ferrari.

If I could have dinner with three famous scientists from history, they would be … Hell, Volhard, and Zelinsky.

And I would ask them … "How come you misspelled my name?"

My first experiment was … setting our house on fire at age 6.

My work is significant because … it keeps me off the streets.

The secret of being a successful scientist is … buy low, sell high (think about it).

The best advice I have ever been given is … do your best science and ignore the rest, so that when you get fired, you can get another job (Bob Bergman, on my arrival at Berkeley in 1974).

My ultimate goal is … to die funded (ascribed to Harry Gray).

A good work day begins with … a quadruple espresso.

My favorite book is … "Molloy" by Samuel Beckett.

My top three films of all time are … "Die Brücke" (1959, directed by Bernhard Wicki), "Woman of the Dunes" ("Suna no onna", 1964, directed by Hiroshi Teshigahara), "Les Visiteurs" (1993, directed by Jean-Marie Poiré).

How is chemistry research different now than it was at the beginning of your career?

There is no doubt that the planning and execution of chemical research has been profoundly affected by advances in technology during the last roughly 40 years. I experienced this change first hand, when I tried to re-enter my own laboratories to carry out some experimental work in 1980, only three years after my last action at the bench. My group threw me out immediately, because I was a major disruption to the smooth functioning of everyday operations. When I started as an Assistant Professor in 1974, we had simple (pre-Fourier Transform) IR and UV/Vis spectrometers, and were restricted by an antiquated T-60 (60 MHz!) NMR instrument, through which everything, except for obvious singlets and simple multiplets, appeared as "blobs". Mass spectrometry was executed at low resolution. Anything deemed fancier had to be obtained from specialized laboratories or by collaboration with experts. The difference between now and then is extraordinary!

Has your approach to chemistry research changed since the start of your career?

My approach to chemistry research has been largely guided by an interest in solving problems, rather than by the desire to cover a specific area. As such, I never felt confined to a topic and, most generally speaking, any atom in the periodic table appeared to be fair game. I get excited about high-energy molecules that encounter unusual reagents and conditions to elicit unprecedented behavior, and then about elucidating in great (some of my co-workers would say excruciating) detail the pathways that describe such behavior. While the more mundane is often necessary, such as the acquisition of kinetic data or the establishment of the scope and limitations of a new process, my guiding principle to my students is "Life is too short to run a boring experiment."

Has your approach to publishing your results changed since the start of your career?

In my early years, I tended to write up new discoveries more quickly, without fleshing them out, a task I reserved for subsequent publications. Now, I wait longer and present a more complete picture, therefore publish less frequently. However, this change has its origins not in some profound realization, but rather is due to age, the associated decreased sense of urgency, and plain laziness. Nevertheless, and at the risk of expressing wishful thinking, I believe that the quality of my papers has improved over the decades (with the caveat that I have reached the age at which I am mixing up the decades).

What do you think the future holds for your field of research?

To quote George W. Bush: "I am no homo sapiens", and the future is hard to predict. However, I like science fiction and, in this vein, one might reasonably well imagine the reaching of a number of current "holy grails", such as: ambient-conditions Haber–Bosch and product-selective Fischer–Tropsch processes; the storage of sunlight for electrical, chemical, and radiative energy; the elimination of harmful waste components from industrial reactions; the implementation of new catalytic transformations that will allow improved chemical manipulation of molecules, especially C–H and C–C activations; the preparation of room-temperature organic/organometallic superconductors; the discovery of new catalytic, selective cross-polymerizations en route to novel smart materials; the attainment of automation in structure analysis and synthesis.

Have you changed the main focus of your research throughout your career and if so why?

As a student, I played in a rock and roll band aptly called "Out of Focus," a descriptor that has plagued me ever since. My research might be described as "In and Out of Focus", as my group has moved from project to project guided by the problems that nature provided. A common motif to most of this work has been the use of transition metals in one form or another, as catalysts or reagents in organic transformations or as scaffolds on which to elicit new chemistry. There have been occasional pressures to switch emphasis toward more applied research, pressures that I have found easy to resist, because I am incompetent in anything practical.

What has been your biggest influence/motivation?

My greatest influences have been my mentors, Peter Garratt (PhD advisor) and Bob Bergman (postdoctoral advisor and, since 1977, fellow faculty member), in addition to my fabulous colleagues at UC Berkeley. My teachers instilled in me the love for chemical research, the curiosity to follow up on unexpected leads, and the intellectual and formal rigor required to execute good science. My colleagues have been an endless source of stimulus and practical help, from providing ideas to using sophisticated equipment. As to motivation, I am genetically driven, and I will not make an attempt to rationalize the many (occasionally inopportune) hours I have spent in teaching and research. If one were to equate motivation with pleasure, I get my biggest kicks out of the thrill of discovering something new, even if seemingly unimportant, and in holding my sophomore organic chemistry class of close to 1000 students at complete attention.

K Peter C. Vollhardt has been featured on the cover of Angewandte Chemie "Syntheses, Structures, and Reactivity of Radial Oligocyclopentadienyl Metal Complexes: Penta(ferrocenyl)cyclopentadienyl and Congeners": Y. Yu, A. D. Bond, P. W. Leonard, K. P. C. Vollhardt, G. D. Whitener, *Angew. Chem.* **2006**, *118*, 1826–1831; *Angew. Chem. Int. Ed.* **2006**, *45*, 1794–1799.

What advice would you give to up-and-coming scientists?

There are two good things about advice: one, it is free, and second, you don't have to take it. In this spirit, my advice would be:

1. Don't do anything that you don't want to; it's bad for your soul.
2. Overcome your fear of flying and jump. High-risk research is disproportionately rewarding.
3. Adopt the highest standards.
4. Be kind.

What is the secret to publishing so many high-quality papers?

In 1992, I crossed the 200 mark in my list of publications, an event that I proudly announced to my colleague Bob Bergman. His laconic response was: "Yeah, but how many good ones?", whereupon I withdrew to my office to brood. I am gratified that most of my peers have found some of my papers worthwhile reading and that this journal has been instrumental in publishing many of them. Of course, there is no secret. My papers are the result of discoveries made by my co-workers. My only contributions have been advice, encouragement, raising money, and entertainment.

My 5 top papers:

1. "A Cobalt-Catalyzed Steroid Synthesis": R. L. Funk, K. P. C. Vollhardt, *J. Am. Chem. Soc.* **1977**, *99*, 5483 – 5484.
   This paper demonstrated for the first time that transition metals could be used in the catalytic construction of complex natural product frames. The article culminated a breathtaking first 3 years as an independent investigator and not only catalyzed a steroid synthesis, but also early promotion to tenure. Sadly, it also marked the end of my presence in the laboratory.
2. "Hexaethynylbenzene": R. Diercks, J. C. Armstrong, R. Boese, K. P. C. Vollhardt, *Angew. Chem.* **1986**, *98*, 270 – 271; *Angew. Chem., Int. Ed. Engl.* **1986**, *25*, 268 – 269.
   This molecule constituted a prototypical example of my love for exotic molecules. Its assembly in one step by a sixfold Sonogashira reaction also taught that multiple Pd-catalyzed C–C bond formations are feasible, an insight that helped pave the way to a myriad of related applications by others. For us, it provided a triple co-cyclization partner for a cobalt-catalyzed synthesis of "starphenylene", trisbenzocyclobutadienocyclohexatriene.
3. "The Heat of Hydrogenation of (a) Cyclohexatriene": H.-D. Beckhaus, R. Faust, A. J. Matzger, D. L. Mohler, D. W. Rogers, C. Rüchardt, A. K. Sawhney, S. P. Verevkin, K. P. C. Vollhardt, S. Wolff, *J. Am. Chem. Soc.* **2000**, *122*, 7819 – 7820.
   When we first made "starphenylene" (trisbenzocyclobutadienocyclohexatriene), its X-ray structure showed complete bond alternation of the cyclohexatriene core. Subsequent theoretical and experimental results confirmed this picture, to the extent that it appeared that the three double bonds were devoid of any interaction whatsoever, the classical hypothetical cyclohexatriene of textbooks, including my own! This paper places these results on a quantitative footing, revealing a heat of hydrogenation that is three times that of cyclohexene (after suitable corrections for strain effects).
4. "Total Syntheses of Angular [7]-, [8]-, and [9]Phenylene by Triple Cobalt-Catalyzed Cycloisomerization: Remarkably Flexible Heliphenes": S. Han, D. R. Anderson, A. D. Bond, H. V. Chu, R. L. Disch, D. Holmes, J. M. Schulman, S. J. Teat, K. P. C. Vollhardt, G. D. Whitener, *Angew. Chem.* **2002**, *114*, 3361 – 3364; *Angew. Chem. Int. Ed.* **2002**, *41*, 3227 – 3230.
   The [*N*]phenylenes are a new class of polycyclic cyclohexatrienoid hydrocarbons synthesized by my group, in which the alternating fusion between (*N*) benzene and cyclobutadiene rings causes unusual activation of the π- and σ-framework. This publication (and the one immediately preceding it in the journal) extends the series of angular derivatives to the helical members that contain up to 9 benzene and 8 cyclobutadiene rings, made by triple intramolecular alkyne cyclizations that involve 9 alkyne units. The physical properties of these systems allow an extrapolation to those of the heliphene polymer, in addition to revealing a remarkably flexible behavior that leads to facile enantiomerization, a consequence of rehybridization at the ring junctions.
5. "Syntheses, Structures, and Reactivity of the First Radial Oligocyclopentadienyl Metals: Pentaferrocenylcyclopentadienyl and Congeners": Y. Yu, A. Bond, P. W. Leonard, K. P. C. Vollhardt, G. D. Whitener, *Angew. Chem.* **2006**, *118*, 1826 – 1831; *Angew. Chem. Int. Ed.* **2006**, *45*, 1794 – 1799.
   This paper argues in the introduction that "… permetalated pentacyclopentadienylated cyclopentadienyls (Cps) are of latent interest as novel tunable dendritic molecules, unusual electronic and magnetic materials, hexametallic "minisurfaces" with potential in catalysis, extremely bulky "supra"Cps, cyclic pentadecker "Ferris wheel" metallocenes, and circumferential annealing precursors to the corresponding unknown semibuckminsterfullerene $C_{30}H_{10}$, the cap of the (5,5)nanotube, or its metalated form." These offings were certainly part of the motivation behind the work, but equally important were the beautiful topologies of the resulting molecules and the fact that they had been predicted to be unmakeable. Long live basic research!

DOI: 10.1002/anie.201007503

