B. M. Trost

Barry M. Trost has recently published his ***30th article*** *since 2000 in Angewandte Chemie:*
"Palladium-Catalyzed Allylic Alkylation of Carboxylic Acid Derivatives: *N*-Acyloxazolinones as Ester Enolate Equivalents": B. M. Trost, D. J. Michaelis, J. Charpentier, J. Xu, *Angew. Chem.* **2012**, *124*, 208–212; *Angew. Chem. Int. Ed.* **2012**, *51*, 204–208.

Barry M. Trost

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Awards:	**1995** Roger Adams Award; **2001** Yamada–Koga Prize; **2004** Arthur C. Cope Award; **2008** Nagoya Medal of Organic Chemistry
Current research interests:	Enhancing synthetic effectiveness has been a major goal. How can the ever-increasing complex molecules required to meet the needs of society in an economical and practical fashion be created? Developing the tools, i.e., the reactions and reagents that enhance chemo-, regio-, diastereo-, and enantioselectivity and impart "atom economy" is the first stage. This goal is pursued in many ways with a major thrust being the rational design of selective catalysts that may make them the equivalent of "chemists' enzymes". Enantioselective catalysts have emerged from the semirational design of "chiral space". Developing ligands that promote spontaneous formation of polynuclear complexes explores potentially more effective catalysts. Coordinating a set of reactions into a sequence that permits the construction of a complex target from readily available starting materials in as short a manner as possible represents the second and final stage.
Hobbies:	Swimming, snorkeling, exploring new cultures

What I first look for in a publication is … to learn something I did not know.

The most important thing I learned from my parents is … self-reliance.

If I could have dinner with three famous scientists from history they would be … Carl Wilhelm Scheele, Friedrich August Kekulé, and Louis Pasteur.

And I would ask them … what prompted them to undertake the work they did. I would also ask Kekulé why he decided to place the chemistry of physiological processes outside the scope of organic chemistry.

The best stage in a scientist's career is … when starting as an independent researcher free from too many preconceptions and inhibiting factors, and willing to try to do the "impossible".

I chose chemistry as a career because … it offered the opportunity for an individual to make a difference in the world by solving problems that make a big difference to the general well-being of people.

My best investment was … reading the scientific literature to broaden my horizons into areas that I would not have otherwise discovered, and which has led me to explore avenues of research that have proven so powerful.

The most exciting thing about my research is … its potential to change the practice of chemistry and, by so doing, enable chemistry to be used more effectively to help solve the problems of society.

A good work day begins with … a student running into my office to tell me about his/her latest results.

My favorite piece of music is … the 1812 Overture by Pyotr Ilyich Tchaikovsky.

Did you always want to be a chemist?

My first exposure to chemistry came when I was about eight years old in the form of a childs "toy," a Gilbert chemistry set. Unlike such toys in the present day, it had real chemicals and interesting experimental protocols using really interesting chemicals to see the effects of chemical reactions. As I think back, it is probably in high school where I actually started thinking about chemistry as a career. The combination of an enthusiastic high-school teacher and exposure to a real laboratory secured my interest.

Is it essential to attempt international exposure during one's formative years?

While such exposure can help it cannot be defined as essential. The only essential thing is to do good science.

How did you deal with any disagreements from the scientific community about your work early in your career? How did this change over time?

I cannot say that I really experienced "disagreements" with the scientific community about our work. There were occasions that we developed methodology for certain transformations simultaneously with other investigators. Our response was to try to show the benefits of the methodology we were pursuing compared to the alternatives.

Do you believe that being in big and reputable institutions enhances the prospect of one becoming well-respected in the chemical community compared to being the head of a smaller laboratory?

The most significant factor to become well-respected in the chemical community is to do good science. The quality of the science also depends upon the quality of the students with whom you are working. To the extent that, on average, the best students tend to congregate around the most reputable schools, the opportunity to perform better science goes up. It is not a size factor but a quality factor.

What makes a good research environment?

A good research environment derives mostly from the interaction of people, especially people with diverse backgrounds and experiences. Good scientific discussions and debates truly stimulate the intellectual atmosphere. They also provide expertise in many aspects of the science. Thus, there is always someone to turn to for help when needed. Of course, having access to the necessary facilities and instrumentation is a given.

What are the characteristics of a scientist that help him or her to continue their research at the highest level for their entire life?

An important personal characteristic is a determination to make a difference. Maintaining scientific interactions at the frontiers of the science contributes significantly to keeping a good perspective as to what is important. Never losing the excitement for the science and for new discoveries provides the enthusiasm that propels me to do better than before and to look for the unconventional. If one is fortunate enough to develop a truly new field of importance, it almost automatically follows that the opportunity to explore and develop the science is immense—much more than one scientist's lifetime. We tried to evolve ideas in areas where few have trodden before. Thus, with a number of the projects that evolved in my laboratories we had many more exciting questions to ask than we can ever answer.

How do you come up with a new idea?

Such a question is almost like asking an artist how does he come up with a new painting. To the extent that I can provide some logic to such a process, I would say it comes from my experiences and extensive reading outside of my immediate areas of interest. By encountering problems in ongoing projects, I was stimulated to think about accomplishing the desired process in a nonconventional fashion. Such thoughts were facilitated by being aware of developments in other areas of chemistry that provided insight into a new reactivity that could solve the problem.

What has frustrated you the most about chemistry?

While chemistry is obviously a science, it is also an art—it does matter who does the science. Lack of reproducibility that sometimes occurs is my most frustrating experiences. Being able to track down the source of the irreproducibility are some of the most satisfying experiences.

What is the nature of the problems that you like to tackle?

Making synthetic chemistry more effective in helping solve the problems of society is the ultimate challenge that fascinates me. How can we truly create synthetic reactions that meet the ideal—being chemo-, regio-, diastereo-, and enantioselective, as well as being atom-economic with anything else needed only catalytically.

What advice would you give to the outstanding students who have passed through your research group?

Professionally, be the best they can be and make a difference.

The interview questions were provided by Stefan Kirsch (University of Wuppertal, Germany).

My 5 top papers:

1. "New synthetic reactions. Allylic alkylation": B. M. Trost, T. J. Fullerton, *J. Am. Chem. Soc.* **1973**, *95*, 292–294.
   This paper was stimulated by our desire to effect replacement of an allylic C–H unit to form C–C bonds. It demonstrated the feasibility of the concept for the first time. It was our first work on the use of palladium to mediate C–C bond formation. This was the birth of our study of metal-catalyzed allylic alkylations and the use of palladium in organic synthesis.
2. "New synthetic reactions. Sulfenylation–dehydrosulfenylation as a method for introduction of unsaturation": B. M. Trost, T. N. Salzmann, *J. Am. Chem. Soc.* **1973**, *95*, 6840–6842.
   This paper spearheaded our development of the use of sulfur as a key element for molecular modification. The ready access of sulfenylated carbonyl compounds heralded a host of synthetic transformations for adjustment of oxidation states with excellent chemoselectivity.
3. "New conjunctive reagents. 2-Acetoxymethyl-3-allyltrimethylsilane for methylenecyclopentane annulations catalyzed by palladium(0)": B. M. Trost, D. M. T. Chan, *J. Am. Chem. Soc.* **1979**, *101*, 6429–

6432.
This paper was the culmination of a rational design of a new unprecedented synthetic reaction. Cycloadditions form multiple bonds in a single event, thereby creating molecular complexity rapidly. This novel transition-metal-catalyzed process proceeding through trimethylenemethane palladium complexes allowed [3+2], [4+3], and [6+3] cycloadditions to form five-, seven-, and nine-membered rings as a complement to the well-known Diels–Alder reaction. The use of a transition metal ultimately allowed the reaction to be performed asymmetrically by designing chiral ligands for palladium.

4. "Asymmetric Ligands for Transition-Metal-Catalyzed Reactions: 2-Diphenylphosphinobenzoyl Derivatives of C_2-Symmetric Diols and Diamines": B. M. Trost, D. L. Van Vranken, *Angew. Chem.* **1992**, *104*, 194–196; *Angew. Chem. Int. Ed. Engl.* **1992**, *31*, 228–230.
This paper addresses a very difficult task—using chiral ligands bound to a metal for outer-sphere transition-metal catalysis wherein the bond-breaking and -making events are distal to the ligands. The rational design of these ligands based upon the principles used by enzymes wherein chiral space imparts asymmetric induction led to the most successful family of ligands for palladium-catalyzed asymmetric allylic alkylation. This process is most unusual among asymmetric metal-catalyzed reactions wherein a wide range of bond types (C–H, C–N, C–O, C–S, C–P, C–C, etc.) can be generated by numerous mechanisms for asymmetric induction.
5. "Ruthenium-catalyzed addition of alkenes to acetylenes": B. M. Trost, A. Indolese, *J. Am. Chem. Soc.* **1993**, *115*, 4361–4362.
This paper revealed the development of an atom-economic process, which potentially has great breadth and utility, by using ruthenium-based catalysis. It was a forerunner of a host of ruthenium-catalyzed multicomponent additions that significantly increased the number of simple additions to our synthetic toolbox. The effectiveness of this chemistry for both inter- and intramolecular processes has been clearly demonstrated by its ability to simplify and increase the effectiveness of the total synthesis of biologically active targets.

DOI: 10.1002/anie.201201017