G. Betrand

*The author presented on this page has published more than **35 articles** since 2000 in Angewandte Chemie, most recently:*
"A Stable Acylic Ligand Equivalent of an Unstable 1,3-Dithiol-5-ylidene": G. Ung, D. Mendoza-Espinosa, J. Bouffard, G. Bertrand, *Angew. Chem.* **2011**, *123*, 4301 – 4304; *Angew. Chem. Int. Ed.* **2011**, *50*, 4215 – 4218.

Guy Bertrand

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Education:	1975 Ingénieur, Ecole Nationale Superieure de Chimie de Montpellier (France) 1979 Doctorat d'Etat, Université Paul Sabatier with P. Mazerolles, Toulouse (France) 1981 Postdoctoral Fellow at Sanofi Research Company with J. P. Maffrand, Toulouse (France)
Awards:	**1998** Médaille d'Argent du CNRS; **1999** Japanese Society for Promotion of Science Award; **2000** Member of the French Academy of Technologies; **2002** Member of the Academia Europea; **2004** Member of the French Academy of Sciences; **2006** Fellow of the American Association for the Advancement of Science; **2009-2010** Sir Ronald Nyholm Medal of the RSC; **2010** Grand Prix Le Bel of the French Chemical Society; **2010** Senior Humboldt Research Award Reinvitation
Current research interests:	For many years, challenging the rules in chemistry textbooks was one of my sources of inspiration, as exemplified by my quest for stable carbenes, diradicals, bent-allenes, etc. I still like to tame reactive molecules, but I also want to transform these compounds into useful tools for synthetic chemists. Recently we have shown that stable carbenes and related metal-free species can activate small molecules and stabilize highly reactive intermediates. Now, we wish to show that these molecules are not only able to break bonds, but that they are also capable of transferring the corresponding fragments to substrates. In other words, we want our organic species to perform tasks that were previously exclusive to transition metal complexes.
Hobbies:	Tennis, skiing… and becoming older: golf and sports cars

When I was eighteen I wanted to be … a professional tennis player.

When I wake up I … wake up my 8-year-old son.

The biggest problem that scientists face is … to convince taxpayers of the importance of science in their day-to-day life.

If I could be anyone for a day, I would be … a cross between Albert Einstein and Roger Federer.

Looking back over my career I would change … nothing, and I prefer to look forward.

My greatest achievement has been … the discovery of the first stable carbene, even if it turned out not to have any applications, in contrast to the N-heterocyclic carbenes of my friend Bo Arduengo.

If I won the lottery I would … buy the same car that Peter Vollhardt already bought and wants to buy again.

If I could have dinner with three famous scientists from history, they would be … August Kekulé, Marie Curie, and Albert Einstein.

I chose chemistry as a career because … I was not good enough to play professional tennis, I did not enjoy mathematics and physics, and at that time I found biology too empirical.

The most important future application of my research is … to replace transition metals by metal-free species (maybe it is only a dream).

In ten years time I will be … a chemist, I will have fun with my students, and enjoy my family.

The worst advice I have ever been given was … never take any risks.

My top three films of all time are … "A Beautiful Mind" (2001, directed by Ron Howard), "Asterix and Obelix: Mission Cleopatra" (2002, directed by Alain Chabat), and "Amadeus" (1984, directed by Milos Forman).

My favorite piece of music is … "The Four Seasons" by Vivaldi.

My worst habit is … smoking.

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

The instrumentation available for chemists is so much more powerful than when I started. This is especially important for us, because we are often dealing with very sensitive, and sometimes short-lived species. I am still amazed to have my students come to my office almost every day with a new crystal structure, whereas at the beginning of my career, we performed X-ray diffraction analyses only in extreme cases. Another big improvement comes from computational chemistry, especially as a predictive tool. Nowadays, we rarely attempt preparing a new species without a theoretical prediction on its potential existence. All these facilities make our science rather easy, and I am a deep admirer of the ancient chemists, who worked without the modern technological tools. I remember, some twenty years ago in Toulouse, we opened some ampules from the Paul Sabatier collection (from the beginning of the 20th century), and according to GC analysis, all of the products were absolutely pure!

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

From the start of my career up to 2001, my approach did not change a lot. However, when I moved from Europe to the US, I have been "forced" to show that the exotic molecules I synthesized were not only laboratory curiosities, but that they were also powerful tools. In other words, I had to look for applications, and this is why I am doing more and more catalysis, which is not at all what I was trained at. Don't take this as a negative comment; now I really enjoy doing catalysis.

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

At the very beginning of my career, I worked in a research group that wanted to publish in French, and in French journals. I very quickly realized that this was the best way to prevent the scientific community from being aware of our results, and as soon as I started my own research group, I drastically changed my publication habits. Since that time, I have always tried to publish in the most recognized journals. I should add that when I believe that either a newly created journal, or an old journal that significantly changes direction, has a good chance to be successful, I do not hesitate to bet on it. For example, in the 1980s I started to publish in *Angewandte Chemie*, and I think it is fair to state that at that time it was merely a German journal, far from the international level it has today.

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

That is a difficult question. Nostradamus tried to answer this kind of questions at the beginning of the 16th century, and as far as I am aware, his prophecies were not totally correct. My best answer would be that the future of chemistry is certainly bright, but the most important breakthroughs are those that we cannot anticipate.

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

The main focus of my research has always been and still is to make molecules that feature an unusual type of bonding. However, because my training was in inorganic chemistry, I first dealt with phosphorus and a little bit with silicon and boron. I then realized that carbon chemistry is believed to be such a mature field that it would be even more striking to find new bonding situations involving this element; our recent isolation of a bent-allene is a good demonstration.

What has been your biggest influence/motivation?

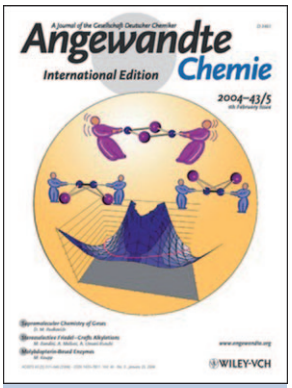
During my PhD, I did not get very nice results because I was a poor experimentalist. Fortunately, my first students and postdoctoral fellows were outstanding. Thanks to their work, we started to have interesting results, and for the first time I became excited by chemistry. Then, at the age of 30, I spent three months as a visiting Professor at the University of Utah in Salt Lake City, where I met tremendous scientists such as Cheves Walling, Bob Parry, Peter Stang, Josef Michl, John Gladysz, etc. I believe that these are the people who have changed my way of looking at my job, and who have had the strongest influence on my career.

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

Choose an "authority challenging" approach: Revolutions (going against the establishment) have led to numerous advances, no matter whether social or scientific progress is concerned. Just like high-risk venture capital companies, I believe that one important discovery could pay off. Be prepared to have wonderful moments…but also terrible ones. Don't give up when you submit your best paper ever and one of the reviewers does not see anything interesting in your publication. Do this wonderful job, but only if it also is your hobby.

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

I will not pretend that they are high-quality papers, but indeed they are published in high-quality journals. I have a big advantage over many of my outstanding colleagues: we are often doing chemistry outside the main stream. Consequently, our findings do not embarrass the reviewers, and they make positive comments…most of the time.



The work of G. Bertrand has been featured on the cover of Angewandte Chemie: "σ-Bond Stretching: A Static Approach for a Dynamic Process": D. Scheschkewitz, H. Amii, H. Gornitzka, W. W. Schoeller, D. Bourissou, G. Bertrand, *Angew. Chem.* **2004**, *116*, 595–597; *Angew. Chem. Int. Ed.* **2004**, *43*, 585–587.

My 5 top papers:

1. "[Bis(diisopropylamino)phosphino]trimethylsilylcarbene: A Stable Nucleophilic Carbene": A. Igau, A. Baceiredo, G. Trinquier, G. Bertrand, *Angew. Chem.* **1989**, *101*, 617 – 618; *Angew. Chem. Int. Ed. Engl.* **1989**, *28*, 621 – 622.
   This paper demonstrated that the title compound, which we had previously isolated and described as a λ^3-phosphinocarbene/λ^5-phosphaacetylene, was indeed a carbene. Therefore, this compound was the first ever isolated carbene, two years before the discovery of an N-heterocyclic carbene by Arduengo. At that time, very few chemists believed that carbenes could be isolated, and nobody thought, including Arduengo and myself, that some years later, carbenes would be ubiquitous ligands for transition-metal-based catalysts, and catalysts in their own right, and that more than 200 research groups in academia and industry would use them.
2. "Facile Splitting of Hydrogen and Ammonia by Nucleophilic Activation at a Single Carbon Center": G. D. Frey, V. Lavallo, B. Donnadieu, W. W. Schoeller, G. Bertrand, *Science* **2007**, *316,* 439 – 441.
   This paper reports the first examples of the activation of small molecules by an isolable carbon-based species. It showed that because they possess a lone pair of electrons and an accessible vacant orbital, singlet carbenes resemble transition-metal centers, and thus could potentially mimic the chemical behavior of transition-metal centers. Moreover, in contrast to the latter, carbenes primarily behave as nucleophiles, which allows for the activation of NH_3, a difficult task for transition metals.
3. "Homogeneous Catalytic Hydroamination of Alkynes and Allenes with Ammonia": V. Lavallo, G. D. Frey, B. Donnadieu, M. Soleilhavoup, G. Bertrand, *Angew. Chem.* **2008**, *120*, 5302 – 5306; *Angew. Chem. Int. Ed.* **2008**, *47*, 5224 – 5228.
   Some of the very first examples of homogeneous catalytic reactions involving ammonia are described in this paper. These reactions give rise to reactive nitrogen derivatives such as imines, enamines, and allyl amines, and are therefore ideal initial steps for the preparation of simple bulk chemicals, as well as rather complex heterocycles. This study paves the way for finding catalysts that mediate the addition of ammonia to simple alkenes, a process of considerable importance, since more than 100 million metric tons of NH_3 are produced per year, and the amount produced of nitrogen-containing compounds is similarly huge.
4. "Isolation of a C5-Deprotonated Imidazolium, a Crystalline 'Abnormal' N-Heterocyclic Carbene": E. Aldeco-Perez, A. J. Rosenthal, B. Donnadieu, P. Parameswaran, G. Frenking, G. Bertrand, *Science* **2009**, *326*, 556 – 559.
   This paper reports the synthesis of a new type of carbon-based species, which are mesoionic in nature, and that we now name "mesoionic carbenes (MICs)". Among their most appealing properties is the difficulty to imagine any dimerization pathways for these compounds, in contrast to classical carbenes with the Wanzlick equilibrium. This observation leads to relaxed steric requirements for their isolation. Moreover, experimental and theoretical data suggest that MICs are even stronger electron-donating species than N-heterocyclic carbenes, which opens interesting perspectives for their applications as ligand for transition-metal-based catalysts. The compound described in this paper is the first representative of a broad family of stable MICs featuring different backbones.
5. "Nonmetal-Mediated Fragmentation of P_4: Isolation of P_1 and P_2 Bis(carbene) Adducts": O. Back, G. Kuchenbeiser, B. Donnadieu, G. Bertrand, *Angew. Chem.* **2009**, *121*, 5638 – 5641; *Angew. Chem. Int. Ed.* **2009**, *48*, 5530 – 5533.
   I like this paper very much because it combines my long-standing interest in both phosphorus and carbene chemistry. White phosphorus (P_4) is readily available, and it is the classical starting material for the industrial preparation of organophosphorus derivatives. Typically, P_4 is treated with Cl_2 gas to make PCl_3 or PCl_5, which are subsequently substituted with organic substrates. To meet the growing demand for phosphorus derivatives and the increasingly stringent environmental regulations, new processes using white phosphorus but avoiding chlorine are highly desirable, and so far no catalytic processes are known to transform P_4 into useful compounds. We believe that the results reported in this paper open an alternative way for the activation of P_4 and possibly advance the discovery processes that involve stable carbenes as catalysts.

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