Angewandte International Edition Chemie

R. G. Compton

The author presented on this page has recently published his ***10th article*** *in Angewandte Chemie in the last 10 years:*
"Oxygen Reduction Mediated by Single Nanodroplets Containing Attomoles of Vitamin B_{12}: Electrocatalytic Nano-Impacts Method": W. Cheng, R. G. Compton, *Angew. Chem. Int. Ed.* **2015**, *54*, 7082; *Angew. Chem.* **2015**, *127*, 7188.

Richard G. Compton

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Position:	Professor of Chemistry and Aldrichian Praelector, University of Oxford
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Education:	1977 BA, University of Oxford 1980 DPhil with Professor W. John Albery, University of Oxford and Imperial College London 1980–1981 Junior Research Fellow, The Queen's College, Oxford, and SERC postdoctoral research assistant with Dr. Barry A. Coles
Awards:	**2004** Volta Medal of the European Section of the Electrochemical Society; **2005** Breyer Medal of the Royal Australian Chemical Institute; **2006** Tilden Lectureship, Royal Society of Chemistry (RSC); **2006** Fellow of the International Society of Electrochemistry (ISE), the RSC, and the International Union of Pure and Applied Chemistry; **2011** Sir George Stokes Award, RSC
Current research interests:	Nanoelectrochemistry; physical electrochemistry; electroanalysis; simulation and modeling of electrode processes
Hobbies:	Reading; travel; good food

I celebrate success by working harder!

My biggest motivation is competition.

My favorite author (fiction) is Mikhail Bulgakov, especially *The Fatal Eggs*, *The White Guard*, and *Heart of a Dog*. But both Hans Fallada (especially *A Small Circus* and *Alone in Berlin*) and Victor Serge (*The Case of Comrade Tulayev*) are close contenders.

The downside of my job is marking undergraduate exam papers.

My favorite food is probably Sichuan Hot Pot. But a big attraction of the academic life is that one encounters a huge variety of places and cuisines. Other favorites are Baltic herrings, Spreewald gherkins, Cancale oysters (which were served at a coffee break at the memorable 17th ISE Topical Meeting in Saint Malo!), Octopus (Galician style), and Brazilian-style beef ("rodízio").

My favorite songs are the complete works of Freddie Mercury/Brian May/Queen: *Keep Yourself Alive*, *Under Pressure*, *Radio Ga Ga*, and all the favorites. And from a more classical perspective: Mahler's 5th Symphony.

My favorite motto is "Nil satis nisi optimum" ("Nothing but the best is good enough"; with apologies to Everton Football Club).

The most important thing I learned from my parents is honesty—absolutely key for doing good, successful science.

If I could have dinner with three famous scientists from history, they would be three scientists who have contributed variously and diversely but importantly to electrochemistry: Armin Stromberg (1910–2004), Wilhelm Ostwald (1853–1932), and Julius Tafel (1862–1918).

And I would ask them about their lives, their science and running a research group. I co-authored a book about Stromberg (*A G Stromberg. First Class Scientist, Second Class Citizen*) describing his life before, during, and after internment in the GULAG during WW2 (Great Patriotic War), including the complete set of 74 surviving letters written to his wife during his imprisonment. Subsequently he founded a thriving school of electroanalysis at Tomsk Polytechnic University. Ostwald received the 1909 Nobel Prize in Chemistry for his work on catalysis. He was a strong atheist and noted for being one of the last scientists to resist the concepts of atomic theory. He was buried at his house in Grossbothen, near Leipzig, which now serves as a museum to his scientific work; I had the pleasure of visiting it some years ago and meeting his granddaughter. Tafel is known for probably the most important equation in electrochemistry and which bears his name. He studied the electrochemistry of organic molecules. He retired prematurely because of ill health but was still frequented by his pupils attending his bedside even during fever spells.

My favorite place on earth is Tallinn, Estonia. Looking out from the top of Toompea over the old, Hanseatic town with its red roofs, spires, and medieval walls and onto the Baltic Sea with boats of all sizes is a truly beautiful and inspiring sight whether in midsummer when the sun hardly sets, or surrounded by the deep snows of winter.

I chose chemistry as a career because the geology of the United Kingdom, and particularly that of Somerset, where I spent my teenage years, is relatively uninteresting—far too much calcium carbonate and too little of the rest of the Periodic Table! Had I grown up East of the Urals, say in Tomsk or Sverdlovsk, I suspect I might well have become a geologist.

My most exciting discovery to date has been reported in our latest paper!

My worst nightmare was visiting Professor Alan Bond in Melbourne at a time when the England cricketers were losing a Test match to the Australians!

I lose track of time when sat in the Gardener's Arms in North Oxford talking with my research group.

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

In terms of management no—I have always taken a bottom-up approach to research in which I prefer to deal directly with as many members of the group as possible rather than having a pyramidal management structure. Ideally supervision is open-door! In terms of research targets, I feel one becomes more ambitious with age, partly since one can manage different outcomes better with experience.

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

I have two suggestions. Firstly, recognize the huge value of teamwork and that this involves human skills that go well beyond simple academic knowledge or experimental excellence. As a background for the list of collaborators I sometimes show at the end of research lectures, I often use a picture by the wonderful Estonian artist Navitrolla who known for his fantastic landscapes and absurd animals. It is called "The Importance of Cooperation" and shows a family of small animals standing on each other's shoulders to successfully access fruit on a tree that is so high as to be inaccessible to taller individual animals (giraffes) stood close by! Secondly, read the literature regularly and thoughtfully. It is amazing how this can change the direction of what you are doing or save enormous time. Similarly take all opportunities to review papers and participate in conferences.

My 5 top papers:

1. "The Electrochemical Detection and Characterization of Silver Nanoparticles in Aqueous Solution": Y. G. Zhou, N. V. Rees, R. G. Compton, *Angew. Chem. Int. Ed.* **2011**, *50*, 4219; *Angew. Chem.* **2011**, *123*, 4305.
   The paper opens up an entirely new approach for the in situ analysis of nanoparticles in solution simultaneously giving their size (down to a few nanometers), concentration, and state of aggregation. It has subsequently been applied not only to metal nanoparticles but also to organic polymeric and metal oxide particles. More recently, the "nano-impact" approach has been used for the analysis of liposomes, micelles, and emulsions of droplets.
2. "Electron transfer kinetics at single nanoparticles": J. M. Kahk, N. V. Rees, J. Pillay, R. Tshikhudo, S. Vilakazi, R. G. Compton, *Nano Today* **2012**, *7*, 174.
   Electron-transfer kinetics mediated by single nanoparticles are quantified and clear differences from behavior seen at the macro- and microscales are established. Specifically, the reduction of protons at silver nanoparticles showed different kinetics and mechanism from those seen at larger physical scales. The scope for changes in electron-transfer behavior at the nanoscale lies at the heart of much new nanotechnology and nanoscience.
3. "Asymmetric Marcus–Hush theory for voltammetry": E. Laborda, M. C. Henstridge, C. Batchelor-McAuley, R. G. Compton, *Chem. Soc. Rev.* **2013**, *42*, 4894.
   The modern molecular Marcus–Hush theory of heterogeneous electron transfer is reconciled with traditional phenomenological Butler–Volmer kinetics. Hitherto these theories were seen as separate and different, their unification gives potential physical insight into the vast array of kinetic data obtained within the Butler–Volmer model.
4. "Understanding nano-impacts: impact times and near-wall hindered diffusion": E. Kätelhön, R. G. Compton, *Chem. Sci.* **2014**, *5*, 4592.
   The idea of "hydrodynamic adsorption" is introduced and is key to understanding the interaction of nanoparticles with surfaces. Specifically, the diffusion coefficient of particles near a surface becomes anisotropic: the diffusion normal to a surface drops to zero as the separation from the surface decreases and that parallel to it is markedly reduced.
5. "Electrochemical detection of single *E. coli* bacteria labeled with silver nanoparticles": L. Sepunaru, K. Tschulik, C. Batchelor-McAuley, R. Gavish, R. G. Compton, *Biomater. Sci.* **2015**, *3*, 816.
   Individual bacteria are detected electrochemically one at a time by means of tagging with electroactive silver nanoparticles, which are too small to be seen on their own but are "preconcentrated" by sticking to the bacterium, thus allowing electrochemical visibility of the latter.

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