

Abragam to Zeugmatography: A Physicist's Fascination with Fields

by

D. I. Hoult
David Hoult Consulting Ltd.,
Winnipeg,
Canada.

Why does a person become a research scientist, and why does a particular area enthrall so? Children are intensely curious, and as a boy, I witnessed the power of the rare and mysterious phenomenon of ball lightning. It rolled across a field and punched a hole in the wall of a local hospital. I was immediately enthralled, and soon very curious about all things electric. Before long, I was picking up paper clips armed with only old tobacco tins, some wire and a steady supply of batteries. But how on earth was it possible to have such "action at a distance"?

Not surprisingly, when I studied physics at Oxford, classical electromagnetism and electronics were my best subjects. Despite excellent tutoring, however, I still didn't (and don't even now) completely understand electromagnetic fields *de profundis*, and it was a constant annoyance, a nagging need that extended to many other areas and made rote learning a terrible chore. I know I drove at least one of my tutors mad by asking utterly fundamental questions he couldn't answer. I was predestined to be a researcher, thanks to genes and a large and lethal glowing ball.

This attitude (pathological need/perfectionism?) has been with me all my life, and with it has come both triumph and trouble. An utterly fundamental understanding enriches confidence and intuition, and whilst the popular vision of a scientist is someone who "stares with self-conceit through horn-rimmed glasses and destroys poetry" (Einstein), scientists who neither listen to their intuition nor let it fuel their imagination are foregoing a major asset.

In the first days of my graduate career with Rex Richards in the Department of Physical Chemistry, I was given the "NMR bible" – Anatole Abragam's *The Principles of Nuclear Magnetism*. I soon intuited that the chapter on signal detection was vague and inapplicable to the newly invented Fourier transform NMR. I suspect the post-doctoral fellows did not know what to make of me! Who was this kid to challenge Abragam? Of course, I was forced to give a very rigorous justification of my views. Then, a few years later, my intuition kicked in again when I read a couple of early zeugmatography (imaging) papers and knew immediately they were wrong. That got me into some trouble, but nowhere near as much as later in my career when I found I was disagreeing with Nobel prize winners! So what do you do when you "just know" papers by very senior scientists are wrong?

Then Rex resigned and moved our research group to the Biochemistry Department. What a shock! *Terra incognita* and about 30% women researchers as opposed to 2% in physics. Why the different demographics? (I think I found a few answers later in my career, when the best physics student I ever had was a woman.) Apart from designing and building a spectrometer, what could I contribute? Again, fundamental understanding of physics (and surprisingly of electronics) came to the rescue once I had learnt a few basic things about muscles. The result was an important paper on examination of muscle metabolism by NMR.

Science and its public perception have changed, particularly in N. America where there is a revolt against rationalism fuelled by fundamentalist religion and complacency on the part of science. Nevertheless, scientific research remains important for the benefit of society, and now my career has ended, I hope I can pass on some of the lessons I have learnt.