Interview

The magic of chemistry

David Leigh has a love of chemistry...and magic. Alison Stoddart finds out more

David Leigh

David Leigh is the Forbes professor of organic chemistry and an EPSRC senior research fellow at the University of Edinburgh, UK. His broad research program involves the design and synthesis of new types of molecular level architectures, including molecular machines.

Who inspired you to become a scientist?
My high school chemistry teacher Dave Clarke. I think that's a common thing amongst chemists. He made chemistry seem fun and exciting. There were several others from my class who went on to do chemistry. Barry Moore, on the chemistry faculty at Strathclyde, also went to my high school.

What motivated you to study molecular machines?
I worked in Fraser Stoddart's group before he made any catenanes or rotaxanes. We made our first catenane about five years after Fraser did. I could see that there was nothing interesting about a catenane or a rotaxane in itself. The interesting thing about them is the possibility to control a well-defined, large-amplitude motion. That's what you need to make a molecular machine. Nature uses controlled molecular motion for everything: photosynthesis, energy storage, the way that muscles move, the way that cells communicate, ion channels. In contrast, mankind, at the beginning of the 21st century, uses controlled molecular motion for nothing. When mankind learns how to control molecular motion, and use it to drive systems away from equilibrium in the way nature does, I am convinced that it will change completely how we design functional molecules and materials.

What are you working on at the moment?
The molecular switches that have been made to date just move between two equilibrium situations. They are molecular machines, but of the very simplest sort. We are working on ways of how to move things away from equilibrium like nature can. The simple rotary motors that we have made work on those principles. We've been making linear ones, including molecules that can walk down tracks just like kinesin walks down a microtubule.

What is the hottest thing in your field at the moment?
Interfacing molecular machines with the outside world. Ben Feringa is doing brilliant things with his motors on surfaces. The rotaxane-based electronics pioneered by Fraser Stoddart is another great thing. That work is really the first interfacing of sophisticated molecules with silicon and electronics.

Do you think we'll ever see molecular machines in our laptops?
I am absolutely sure that we will. But whether they'll actually be interfaced in the sort of cartoon depiction that we see today, that I'm not so sure of.

You like to practice magic. What is the most magical thing about chemistry to you?
Chemistry allows you create things that never were and to change the world and change society, and that's an amazing thing. James Clerk Maxwell, the 19th century Scottish physicist, came up with the theory that light was really electromagnetic radiation. A feat of which Richard Feynman said, '...ten thousand years from now - there can be little doubt that the most significant event of the 19th century will be judged as Maxwell's discovery of the laws of electrodynamics.' I think there are still those kinds of things to be discovered and there is still that impact to be had on society.

How long have you been a magician?
I used to play bridge as a youngster – I was an international bridge player and I learned a few cards tricks. Then I had to give up bridge in order to carry on being a chemist. When I started lecturing, I realised I knew a card trick that would illustrate a point. I did it and the students really liked it, so I started to do it more and more in my undergraduate tutorials and lectures. It's difficult to use card magic in a lecture because cards are small, so I started to learn other sorts of magic for my research lectures. I really love having the chance to perform to a large crowd, which I would never otherwise have the opportunity to do.

If you weren't a scientist what would you be?
I could have been a professional card player, but it's actually quite boring and that is one of the reasons I chose chemistry. Also, I was better as a scientist than I was as a bridge-player!

Who has been most influential on your career?
The people to whom I owe the greatest debt are Jim Feast, Dave Sherrington and Phil Hodge. They were in charge of the innovative polymer synthesis initiative that was done in the early 1990's in the UK. A whole series of chemists like me, Neil McKeown, Steve Armes and Dave Haddleton, benefited directly from those guys, who pushed forward polymer chemistry in a really promising way. I owe an enormous debt to those guys. There's no way that my research would be where it is without their support.

What advice would you give to a young researcher?
To have big ideas – don't do routine work. Tackle big problems. Whatever field they choose they should try and make a big impact. Just because you only have a small group, doesn't mean you can't do great things. There is plenty of room at the top!