Interview with Harry Kroto

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ABSTRACT Chief Editor, Cleodie Swire, interviewed Sir Harold Kroto, Nobel Prize winner.

Professor Sir Harold Kroto FRS [Figure 1] is a British chemist who is most famous for being one of the Nobel-prize winning discoverers of buckminsterfullerene, known as `buckyballs' [Figure 2]. This is a spherical cage-like molecule with the formula C60 which can be used to encage and transport other molecules [Box 1]. He now works at the University of Florida, USA. For a brief biography, see Box 2.

What made you interested in science?

I'm not sure that anything did, other than being interested in Meccano and being told by my father that I'd better be interested in science and mathematics. My main interest as a kid at school was geography, and art and graphics.

What was the turning point when you decided to pursue chemistry?

I had a teacher who took an interest in me and a couple of other students, and encouraged me to go to Sheffield University, which at the time was probably the best chemistry department in the country.

In your opinion, why is it important that we continue to study chemistry?

Chemistry is an overarching subject, and almost everything to do with sustainability and survival today involves chemistry.

Science for life: I think it is important to have a scientific background; everyone should do science and mathematics to a reasonable degree so that they have some appreciation of the culture that created modern lifestyles. The more you understand the technology in the modern world, the better decisions you will make if you are in a position of responsibility. Many of the important decisions made nowadays involve scientific understanding: climate change, fuel problems, medical issues, etc. It's a basis for giving people a better understanding of the world we are in.

Take no one's word for it: Science for me has a deeper intellectual aspect and I call it 'natural philosophy'. Natural philosophy is defined in the following way: it is the only philosophical construct that we have to determine truth with any degree of reliability.

For instance, do you think that the Earth goes round the Sun or the Sun goes round the Earth? Until Galileo, people believed that the Sun goes round the Earth – if you look outside the window, this is how it looks.The Royal Society has the motto 'Take no one's word for it' – the questioning of everything is what science is about. Common sense suggests that the Sun goes round us; it's actually quite complicated to prove the truth, which involves Foucault's pendulum [Figure 3] showing that the Earth is rotating.

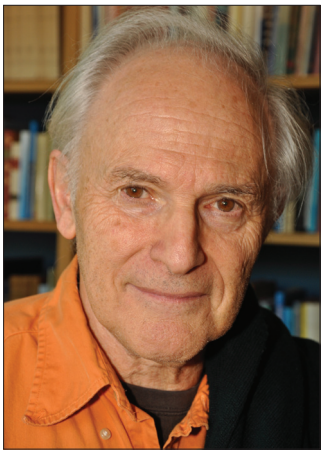

Figure 1: Harry Kroto [available from http://en.wikipedia.org/wiki/Harry_Kroto]

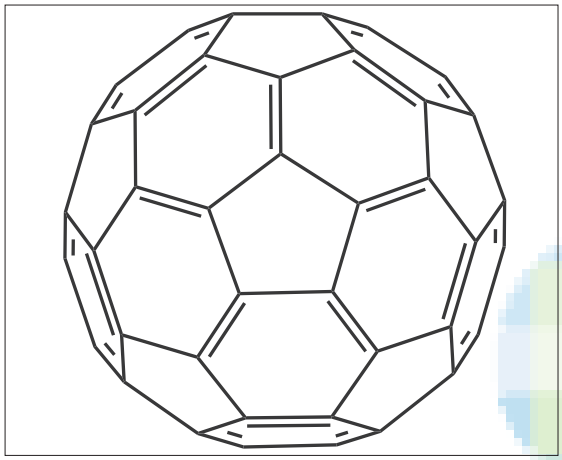

Figure 2: Buckminsterfullerene [available from http://en.wikipedia.org/wiki/Buckminsterfullerene]

Figure 3: Foucault's pendulum at the Pantheon, Paris [available from http://en.wikipedia.org/wiki/File:Pendule_de_Foucault.jpg]

Once you realize that, you appreciate how easily people can be misled. I don't respect anybody who cannot prove to me what they are telling me on the basis of evidence. You must be really careful about accepting things without evidence. You should tell your teachers that it's obvious that the Sun goes round us – common sense suggests it. It's actually uncommon sense that you need to understand nature – it is uncommon sense that makes a scientist look a little more deeply and decide that something isn't quite right.

BOX 1

Buckminsterfullerene, discovered in 1985, is made up of twenty hexagons and twelve pentagons with a carbon atom at each vertex. It is very stable; it maintains its shape when it reacts with other substances, and does not react with entrapped molecules. Lanthanum carbide, which readily degrades in air, has been stored in C_{60} for more than six months![1]

BOX 2

Harry Kroto was educated in England, studying at the Universities of Sheffield and Sussex. He was one of the recipients of the 1996 Nobel Prize in Chemistry. Kroto is currently the Francis Eppes Professor of Chemistry at the Florida State University, and is carrying out research on nanoscience and nanotechnology.[2]

How has technology affected the type of work chemists do throughout your career?

Enormously – it has changed life completely. Technology now is so efficient and so complex and so inscrutable that people are using technology without knowing what is going on. Twenty years ago, if someone told that you could talk to anybody, anywhere in the world with something the size of a

cigarette packet, you would have thought they were crazy.

Today there is a disconnection from technology. Up until the big advance in technology in the last part of the twentieth century, most people knew how something worked because when it went wrong, you had to fix it, you didn't just throw it away and replace it. By fixing things, you learn how they work.

What do you view as being the most exciting application that has come from the discovery of buckminsterfullerene?
It's being tested at the moment as a rather good dopant in solar cells (see The Sun's the Limit, p . 6-10). There will be a market for organic-based solar cells, rather than silicon-based ones. It's possible that we will make some very inexpensive organic polymers which will not need a battery, and using C_{60} as a dopant in these solar cells improves the efficiency of the electricity production by several orders of magnitude.

Up to now, the contribution buckminsterfullerene has made to science has been quite a fundamental learning point because we learned that it self-assembles. People didn't think that it would self-assemble, which shows that we don't know much.

Do you have any advice to young people?
Never do anything where a second-rate effort will satisfy you. If it does, go and find something else. Do something to the best of your ability. If you are prepared to work 25 hours a day, eight days a week on a project, then you've chosen the best thing for you to do.

That is the determination that I have, though not everyone does. I never do anything where a second-rate effort will satisfy me. If you find something you feel that way about, then you will almost certainly do it better than others who may have the potential to do it better than you, but don't have that determination in that particular area.

You've got to satisfy yourself – you shouldn't be doing it to get a good mark, but to feel that you are doing the best you could possibly do. That's a good recipe for success in the future, I think.

References

1. Buckminsterfullerene. Available from: http://en.wikipedia.org/wiki/Buckminsterfullerene. [Last accessed on 2012 Mar 3].
2. Harry Kroto's Curriculum Vitae. Available from: http://www.kroto.info/General_info/CV_A.html. [Last accessed on 2012 Mar 3].

About the Author

Cleodie Swire is currently studying Biology, Chemistry, Physics and Further Maths at A Level. She hopes to study Medicine at University. She enjoys sport and travelling.