The Next Big Thing: Nanotechnology

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COLIN
Are we on the verge of a tiny atomic revolution that will have a huge impact on our lives? Will nanotechnology create molecular machines that repair our bodies, and ultra fast computers that can be painted on the wall. To discuss the science fact and fiction of atomic scale engineering, I'm joined by Sir Harry Kroto, Professor of Chemistry at Sussex University. Harry shared the Nobel prize in 1996 for the discovery of a new form of carbon, commonly called bucky balls. Doctor Jim Gimzewski is a researcher at IBM in Zurich. Jim specialises in atomic scale manipulation and construction. Peter Dobson is Professor of Engineering at the University of Oxford, and founder of the nanotechnology company Nanox. And our regular guest Jackie McGlade, Professor of Mathematics at University College London. Well first Harry, can you tell us what nanotechnology is?

HARRY
Yes it's a technology which focuses on constructing, structures, well clusters, of atoms probably ten, a hundred or a thousand at a time, at a scale which will be something like a billionth of a metre, that is ten to the minus nine of a metre.

COLIN
And that's the nano in nano technology.

HARRY
Yes I mean it should really be nanometre scale technology, and some people still feel it should be but I think they've lost that particular battle. It will be nanotechnology from now onwards.

COLIN
Okay now what, fundamentally what's the difference between this way of thinking about problems and just miniaturisation, just making ordinary devices a bit smaller, is there anything fundamentally different Jim?

JIM
Well I think fundamentally what's different to the whole thing is if we imagine classically we have things like engineering, we have biology, we have chemistry and these are very different disciplines, and over time our understanding of all these disciplines has now come down to the scale of individual atoms and molecules okay. So there's a whole lot of new opportunities, there are a whole lot of new paradigm shifts we can expect.

JACKIE
From what you're saying, it would almost be that engineers have to sort of really think like biologists, they've got to think about the possibility that the structures could grow, they can actually change form, they could actually, well in a sense change before their very eyes, they have to be more predictive about the dynamics of them.

JIM
Yeah so the…

JACKIE
….that's quite a revolution I would have thought.

JIM

We have the opportunity now to do engineering and I mean, mechanical engineering on a scale where we have to perhaps think non-intuitively and we have to look to biology for instance for the operational principles…

JACKIE
…well and mathematics as well…

HARRY
Can you get a molecule to behave like an element on a computer chip or can you build out of atoms a machine. Now living systems have already done that. I mean haemoglobin is a molecular machine, that's how Max Perutz described it, he was the first structure of a molecular machine. So biology has done it. Now what we want to do is we want to go, learn from biology, and build them, not out of proteins but out of rigid structures or floppy structures where we have some control, and so we, we're being guided in that way.