Balanzas basadas en nanotubos: pesando en la escala molecular

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Interviewer - Chris Smith
But first, Richards, the world of weighing has taken a big step forward on the nanoscale problem, talk to us about this.

Interviewee - Richard Van Noorden
Well, some Spanish researchers this month from the Nanoscience Research Center in Barcelona, gave us yet another example of these amazing ultra-sensitive carbon nanotubes that can weigh molecules to miniscule resolutions. So these guys led by Adrian Bachtold created a device that could weigh proteins to a resolution of within three gold atoms.

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How does it work?

Interviewee - Richard Van Noorden
Well, this protein weighing machine is a nanotube and its pinned between two electrodes and a vacuum and the nanotube is a resonator that vibrates like a guitar string to frequency and when an atom hits it, it changes it's frequency of vibration and by relating that to mass you can weigh very tiny particles. Now the question is, is this ever going to replace a mass spectrometer, which is the usual way we use to measure mass by fragmenting molecules up and sending them flying through a tube and bouncing electric and magnetic fields to work out how heavy they are, and the exciting thing is these guys say in the future these tiny nanotubes will improve on mass spectrometers. They are not quite there yet, so we decided to ask them and other groups how this might work. What they say is, it could be possible to make devices that could discriminate between isotopes of the same element, could follow reactions of single protein. So you could put haemoglobin on molecule on a nanotube and look over time how it, say, releases oxygen atoms as it reacts, which is pretty incredible. Now mass spectrometer, at the moment, they can get down to the resolution of a hydrogen atom. But as molecules get bigger and bigger, when you talk about the size of proteins, they just don't have that resolution. So, really these nanotubes are offering something that mass spectrometers can't give you.

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Now, the principle ways reasonably straightforward. You vibrate something and when you add weight to it, the vibration changes, but how do you actually measure the vibration in the first place. How are they doing that?

Interviewee - Richard Van Noorden
What is often done optically, you can do with a laser beam and you shine the laser beam and you can see how that change as it comes out and you can relate that to vibration and that's normally the way it's done. In fact, one team, California-Berkeley team led by Kenneth Jensen they've made a vibrating cantilever that can get down to a 2/5th's of a gold atom and this also works at room temperature, so we're talking tiny resolutions there.

Interviewer - Chris Smith
If we can already do this with a mass spectrometer, why do we want to do with anything different?

Interviewee - Richard Van Noorden

Well, the advantages nanotubes might offer are first, sensitivity, mass spectrometers are very sensitive, but as you get to really large molecules, that little difference in an oxygen atom being lost, it gets hard to detect. Secondly, we've got the size and the weight. The nanotube is very light; an array of them would still be miniscule, very light should be easy to carry around, when put in a device. and though mass spectrometers are getting hand-held, they're not going to be able to compete with that and the really exciting thing about being able to determine between different isotopes, determine how proteins are reacting, follow chemical reactions just by real-time mass detection, as molecules land on nanotubes that are around, that's pretty exciting and that's where this research is headed.

Interviewer - Chris Smith

It's exciting and we can see all kinds of potential for that if we are cantering them down because of course it makes them very portable and then you can do things up like bio-detection and other things like environmental monitoring. Thanks Richard.