



150-year-old idea inspires nanomachine

'Maxwell's Demon' traps molecules as they move naturally

By Patricia Reaney
REUTERS

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LONDON - Nearly 150 years ago it was no more than a concept by a visionary scientist, but researchers have now created a minuscule motor that could lead to the creation of microscopic nanomachines.

Scottish physicist James Clerk Maxwell first imagined an atom-size device dubbed Maxwell's Demon in 1867. Scientists at the University of Edinburgh have made it a reality.

"We have a new motor mechanism for a nanomachine," said David Leigh, a professor of chemistry at the University.

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A nanomachine is an incredibly tiny device whose parts consist of single molecules. Nature uses nanomachines for everything from photosynthesis to moving muscles in the body and transferring information through cells.

Scientists are trying to unravel the secrets of nanomachines and nanotechnology, which works on a tiny scale. One nanometer is a billionth of a meter, or about 80,000 times smaller than the thickness of a human hair.

"Molecular machines allow life itself to occur at a molecular level. Our new motor mechanism is a small step towards doing that sort of thing with artificial molecular machines," Leigh told Reuters.

His mechanism traps molecular-sized particles as they move. As Maxwell had predicted long ago, it does not need energy because it is powered by light.

"While light has previously been used to energize tiny particles directly, this is the first time that a system has been devised to trap molecules as they move in a certain direction under their natural motion," said Leigh, who reported the findings in Thursday's issue of the journal *Nature*. "Once the molecules are trapped, they cannot escape."

Leigh credits Maxwell for establishing the fundamentals for understanding how light, heat and molecules behave.

In an earlier study, he and his team showed that a nanomachine could move a droplet of water uphill by using molecular force. Although the movement was small, it was a big step in learning to make machines with artificial molecules.

The new motor mechanism will enable scientists to do things that are much closer to what biological machines do.



Regina Fernandes / Illographics

This fanciful illustration shows the idea behind "Maxwell's Demon," a molecular machine conceived by James Clerk Maxwell in 1867. The atom-scale device captures molecular rings as they move from one compartment to another. Molecules check in, but they don't check out.

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Nanotechnology is already being used in cosmetics, computer chips, sunscreens, self-cleaning windows and stain-resistant clothing.

Leigh believes nanoscale science and engineering could have a huge impact on society — comparable to the impact of electricity, the steam engine and the Internet.

But quite how, is difficult to predict.

"It a bit like when stone-age man made his wheel asking him to predict the motorway," he said.

"It is a machine mechanism that is going to take molecular machines a step forward to the realization of the future world of nanotechnology. Things that seem like a Harry Potter film now are going to be a reality."

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