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Tiny engine boosts nanotech hopes

Prototypes of microscopic engines that could power molecular machines have been brewed up in a Scottish laboratory.



Nano-scale engines make possible such things as muscle movements

Scientists at the University of Edinburgh have created a tiny engine powered by light that can be made to sort molecules.

The device may one day find a role in nano-scale machines.

It emerged from research into similar tiny machines in nature that power well known processes such as photosynthesis.

Small wonder

Nanotechnology typically involves components built of individual atoms or molecules. A nanometre is one billionth of a metre and is about 80,000 times smaller than the thickness of a human hair.

Led by Professor David Leigh the team from Edinburgh have designed and built a molecule, known as a rotaxane, that can move and sort particles. It took three years of painstaking work to find a molecular form that could do this job.

Conceptually, the rotaxane can be thought of as a barbell with a carefully positioned lump on the bar that can be made to act as a one-way "gate" when light is shone on it.

"We have a new motor mechanism for a nanomachine," said Prof Leigh.

"It is a machine mechanism that is going to take molecular machines a step forward to the realisation of the future world of nanotechnology," he said.

Because the rotaxane can be made to do useful work in a predictable fashion, ie sort particles, it could become a key component for anyone designing nano-scale devices.

The findings of the team were reported in the journal Nature.

Some of the inspiration for the tiny engine came from a thought experiment first conceived by pioneering physicist James Clerk Maxwell.

Although best known for his work on electromagnetism, he also dreamed up the idea of Maxwell's Demon in which an imp seems to be able to sort gas molecules into separate chambers in defiance of the second law of thermodynamics.

In previous work Prof Leigh's group have used a manufactured nanomachine to move a water droplet uphill.

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