

# News in science

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## Chemists take 150 years to build nanomotor

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Reuters

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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 Professor James Clerk Maxwell first imagined an atom-size device dubbed Maxwell's demon in 1867.

Now scientists at the [University of Edinburgh](#) have made it a reality.

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

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 nanometre is a billionth of a metre, 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 says.

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 energise 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," says Leigh, who reports the findings in 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.

### Taming the demon

In the 1800s, Clerk Maxwell thought up what is now known as Maxwell's demon, a hypothetical creature that moves systems away from equilibrium without using energy.

The demon guarded a trapdoor between two separated gas-filled compartments to let gas molecules pass between the two.

The creature let fast-moving molecules travel one way and slow-moving ones the other, until the fast-moving molecules heated one chamber.

This change in temperature, or movement away from equilibrium, would have violated the second law of thermodynamics.

The researchers publishing in *Nature* today tried to mimic this, by creating a machine that moves away from the equilibrium, ie moves, without using energy.

The machine moved, with the help of molecular ratchets to pull themselves along under their natural motion. But it needed light to fuel that movement.

### An uphill struggle

In an earlier study, Leigh and his team showed that a nanomachine could move a drop up 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 allow scientists to do things that are much closer to what biological machines do.

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Maxwell's demon, a hypothetical creature that moves systems away from equilibrium without using energy, inspired the new nanomotor (Image: Regina Fernandes, Illugraphics)

