

Scientists invent 1.2nm molecular gear

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Scientists from A*STAR's Institute of Materials Research and Engineering (IMRE), led by Professor Christian Joachim, have scored a breakthrough in nanotechnology by becoming the first in the world to invent a molecular gear of the size of 1.2nm whose rotation can be deliberately controlled. This achievement marks a radical shift in the scientific progress of molecular machines and is published in *Nature Materials*, one of the most prestigious journals in materials science.

Said Prof Joachim, "Making a gear the size of a few atoms is one thing, but being able to deliberately control its motions and actions is something else altogether. What we've done at IMRE is to create a truly complete working gear that will be the fundamental piece in creating more complex molecular machines that are no bigger than a grain of sand."

Prof Joachim and his team discovered that the way to successfully control the rotation of a single-molecule gear is via the optimization of molecular design, molecular manipulation and surface atomic chemistry. This was a breakthrough because before the team's discovery, motions of molecular rotors and gears were random and typically consisted of a mix of rotation and lateral displacement. The scientists at IMRE solved this scientific conundrum by proving that the rotation of the molecule-gear could be wellcontrolled by manipulating the electrical connection between the molecule and the tip of a Scanning Tunnelling Microscope while it was pinned on an atom axis.

Said Dr Lim Khiang Wee, Executive Director of IMRE, "Christian and

his team's discovery shows that it may one day be possible to create and manipulate molecular-level machines. Such machines may, for example, walk on DNA tracks in the future to deliver therapeutics to heal and cure. There already exists at least one international roadmap for creating such productive nanosystems. As we push the frontiers of nanotechnology, we increase our understanding of new phenomena at the nanoscale. This paper is a valuable step on the long road to applying this understanding for discoveries and breakthroughs in [nanotechnology](#) and bring to reality the tiny nanobots and nanomachines from science fiction movies."

Source: Agency for Science, Technology and Research

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