New Ribosome-Inspired Molecular Machine Developed

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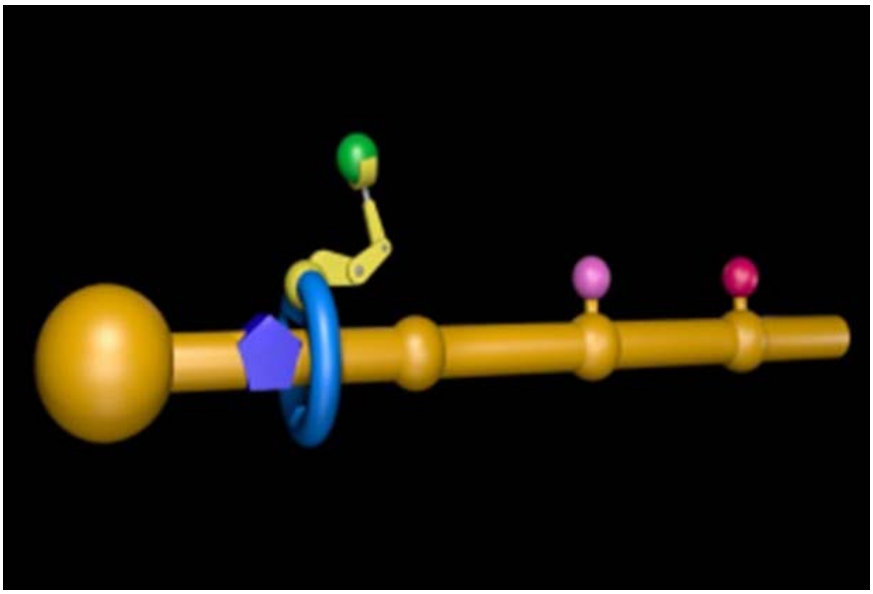

Image Credit: University of Manchester

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Researchers at the University of Manchester have developed a machine that can effectively mimic the process by which the ribosome translates genetic code to build protein in the cells of our bodies.

The nanomachine, which is only a few millionths of a millimeter long, was constructed by professor David Leigh of the university's School of Chemistry, and in a statement, the institute called it "the most advanced molecular machine of its type."

Leigh also compared the process to the way robotic assembly lines operate in automotive plants, and said it could ultimately help make the manufacturing of molecules "much more efficient and cost effective." A paper detailing the development of the machine has been published in the journal Science.

According to Nature's Mark Peplow, Leigh's machine is much simpler than the ribosome, only about one-tenth of its size, and far slower. It also destroys all of the code it reads and is only able to create very small bits of protein (also known as peptides), but Leigh believes it could be used for a number of different purposes.

"Ribosomes make proteins, which are just one type of polymer used by nature. In fact, all of biology is based on just four sorts of so-called information polymers – proteins, DNA, RNA and also carbohydrates. But with our artificial machines, we're not limited by the same building blocks of nature," the professor told BBC News. "So, we should be able to make new materials with other types of building blocks – new types of plastics, new types of catalysts, pharmaceuticals and so on."

The method used with the nanomachine requires a large molecular ring (also known as a rotaxane), which is threaded into another molecule, which acts like an axle. This axle is lined with three amino acids, and a chain of three more hang from the ring's outer edge.

One of the attached amino acids is cysteine, which Peplow reports includes a crucial sulfur-containing thiol group. When the system is heated, the thiol group snatches an amino acid from the axle and transfers it to the end of the attached chain of amino acids.

"The ring can then move along the axle and repeat the same trick with the next two amino acids. Unthreading the ring and breaking off the newly-formed chain delivers a perfectly formed peptide made from all six amino acids," he added. Although Leigh's rotaxane mimics the ribosome in its sequential building of peptides, the sulphur-assisted amino acid transfer is found elsewhere in biology: some bacteria rely on it to synthesize proteins. It has also become a standard technique in laboratory protein synthesis."

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