U.S. researchers develop artificial pore

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Using an RNA-powered nanomotor, University of Cincinnati (UC) researchers have successfully developed an artificial pore able to transmit nanoscale material through a membrane.

In the study, researchers inserted the modified core of a nanomotor, a microscopic biological machine, into a lipid membrane. The resulting channel enabled them to move both single- and double-stranded DNA through the membrane.

The findings were published in the Sept. issue of Nature Nanotechnology.

"The engineered channel could have applications in nano-sensing, gene delivery, drug loading and DNA sequencing," said UC biomedical engineering professor Peixuan Guo, who led the study.

Guo and his team derived the nanomotor used in the study from the biological motor of bacteriophage phi29, a virus that infects bacteria.

Previously, Guo discovered that the bacteriophage phi29 DNA-packaging motor uses six molecules of the genetic material RNA to power its DNA genome through its protein core, much like a screw through a bolt.

"The re-engineered motor core itself has shown to associate with lipid membranes, but we needed to show that it could punch a hole in the lipid membrane," says David Wendell, co-first author of the report and a research assistant professor in UC's biomedical engineering department.

"That was one of the first challenges, moving it from its native enclosure into this engineered environment," Wendell said.

In this study, UC researchers embedded the re-engineered nanomotor core into a lipid sheet, creating a channel large enough to allow the passage of double-stranded DNA through the channel.

Guo said past work with biological channels has been focused on channels large enough to move only single-stranded genetic material.

"Since the genomic DNA of human, animals, plants, fungus and bacteria are double stranded, the development of single pore system that can sequence double-stranded DNA is very important," he said.

By being placed into a lipid sheet, the artificial membrane channel can be used to load double-stranded DNA, drugs or other therapeutic material into the liposome, other compartments, or potentially into a cell through the membrane.

Guo also says the process by which the DNA travels through the membrane can have larger applications.

"The idea that a DNA molecule travels through the nanopore, advancing nucleotide by nucleotide, could lead to the development of a single pore DNA sequencing apparatus, an area of strong national interest," he said.

Source:Xinhua

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