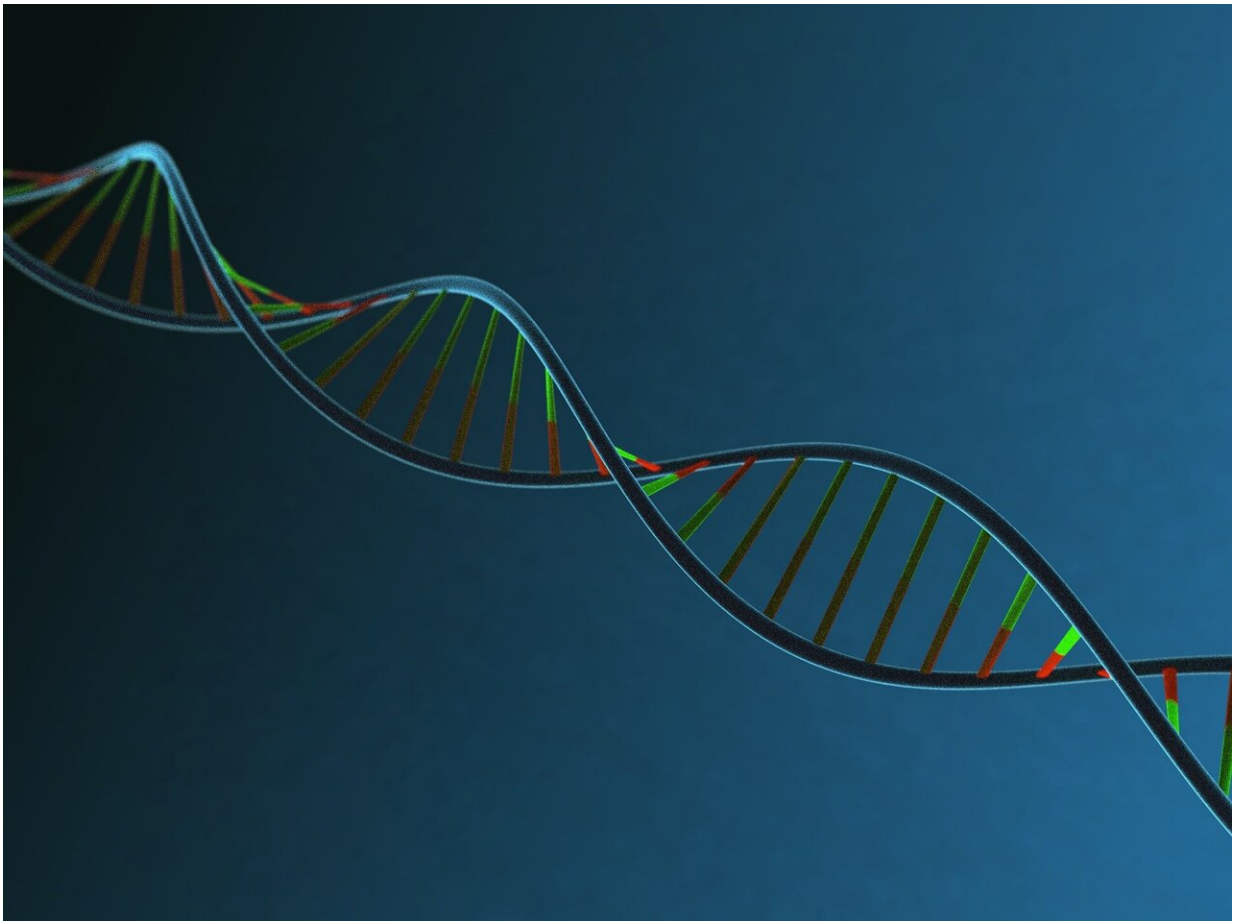


# Scientists develop novel mode of linear hybridization chain reaction

November 28 2022, by Zhang Nannan

---



Credit: Pixabay/CC0 Public Domain

Hybridization chain reaction refers to an enzyme-free nucleic acid

polymerization reaction. A target molecule triggers cascade hybridization reactions by several thermodynamically stable DNA fuel strands, producing ultra-long DNA nanostructures with nicks. Signal amplification of the target molecule can be achieved by the application of a hybridization chain reaction.

Scientists from the Suzhou Institute of Biomedical Engineering and Technology (SIBET) of the Chinese Academy of Sciences have developed a new type of linear [hybridization](#) chain reaction that couples [magnetic nanoparticles](#) and [silver nanoparticles](#) for highly sensitive and selective analysis of target [nucleic acids](#).

Fe<sub>3</sub>O<sub>4</sub> [nanoparticles](#) were first prepared for rapid magnetic separation and gold nanoparticles were formed on the surface for the immobilization of DNA strands. "Due to the huge specific area, a large number of DNA probe A can be immobilized," said Miao Peng, leading researcher of the study at SIBET.

This [probe](#) contains four functional regions, among which two are complementary to the target miRNA.

After the introduction of DSN, DNA/RNA duplexes formed, and the digestion reactions released target miRNA strands for recycled reactions, and created single-stranded Probe B and C to further act on the DNA triangular prism structure at the electrode surface.

On the other hand, triangular prism structured 3D DNA (TPDNA) was assembled at the electrode surface as the recognition layer. TPDNA showed geometrical rigid structure, which provides suitable sites to capture probes B and C.

The localized strands offer two single-strand regions, which were used to capture the fuel strands of H1, H2, H3 and H4. A long ladder-like DNA

structure was formed which possesses multiple amino groups for immobilizing silver nanoparticles as strong electrochemical probes.

After measuring the silver stripping peak intensity, the initial target miRNA level can be evaluated. The nanomaterials involved in this work were fully characterized, and the corresponding reactions have been verified by polyacrylamide gel electrophoresis and electrochemical techniques. Under optimized experimental conditions, the detection limit of  $5 \times 10^{-18}$  mol/L can be achieved with good sequence selectivity.

Satisfactory results have been obtained in actual clinical sample assays, according to Miao.

Results of the study were published in *Biosensors and Bioelectronics*, titled "Ultrasensitive miRNA biosensor amplified by ladder hybridization chain reaction on triangular prism structured DNA."

**More information:** Hua Chai et al, Ultrasensitive miRNA biosensor amplified by ladder hybridization chain reaction on triangular prism structured DNA, *Biosensors and Bioelectronics* (2022). [DOI: 10.1016/j.bios.2022.114900](https://doi.org/10.1016/j.bios.2022.114900)

Provided by Chinese Academy of Sciences

Citation: Scientists develop novel mode of linear hybridization chain reaction (2022, November 28) retrieved 11 May 2024 from <https://phys.org/news/2022-11-scientists-mode-linear-hybridization-chain.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.