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Dual-functional nanoplatform for simultaneous degradation of circRNA *CDR1as* and real-time monitoring of miR-7 in live cells

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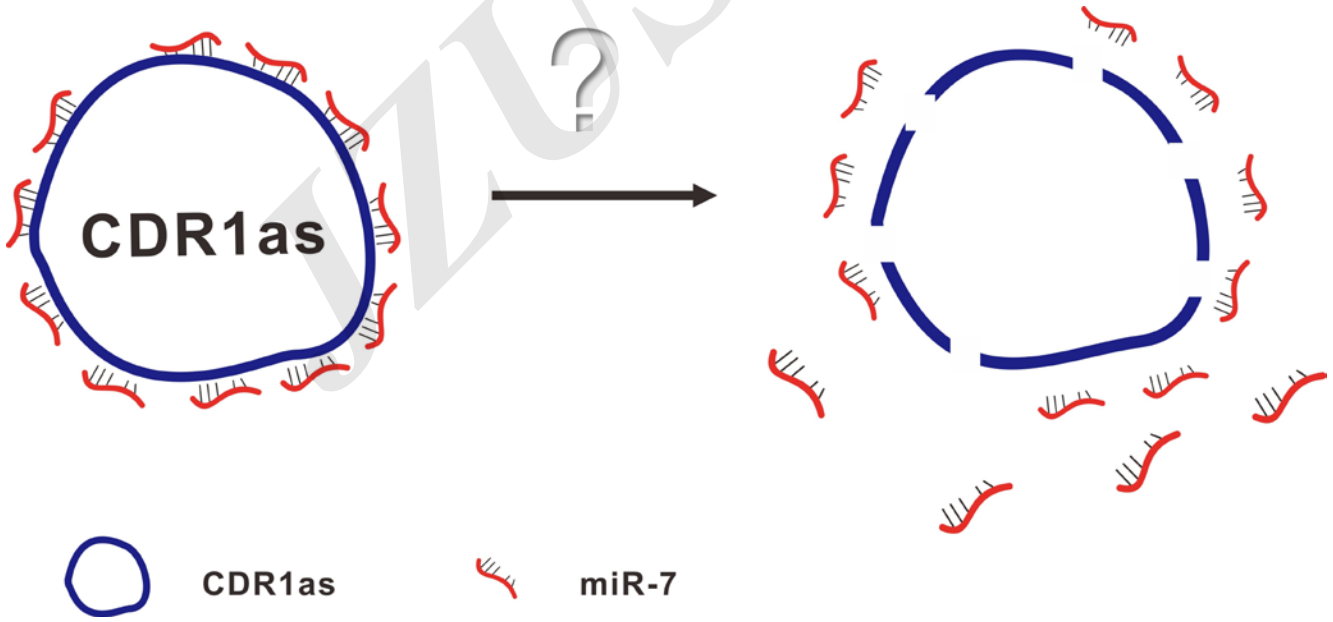
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Key words: Circular RNA (circRNA); Zeolitic imidazolate framework-8 (ZIF-8); MicroRNA-7 (miR-7); DNAzyme; Gene regulation

Background & Challenge

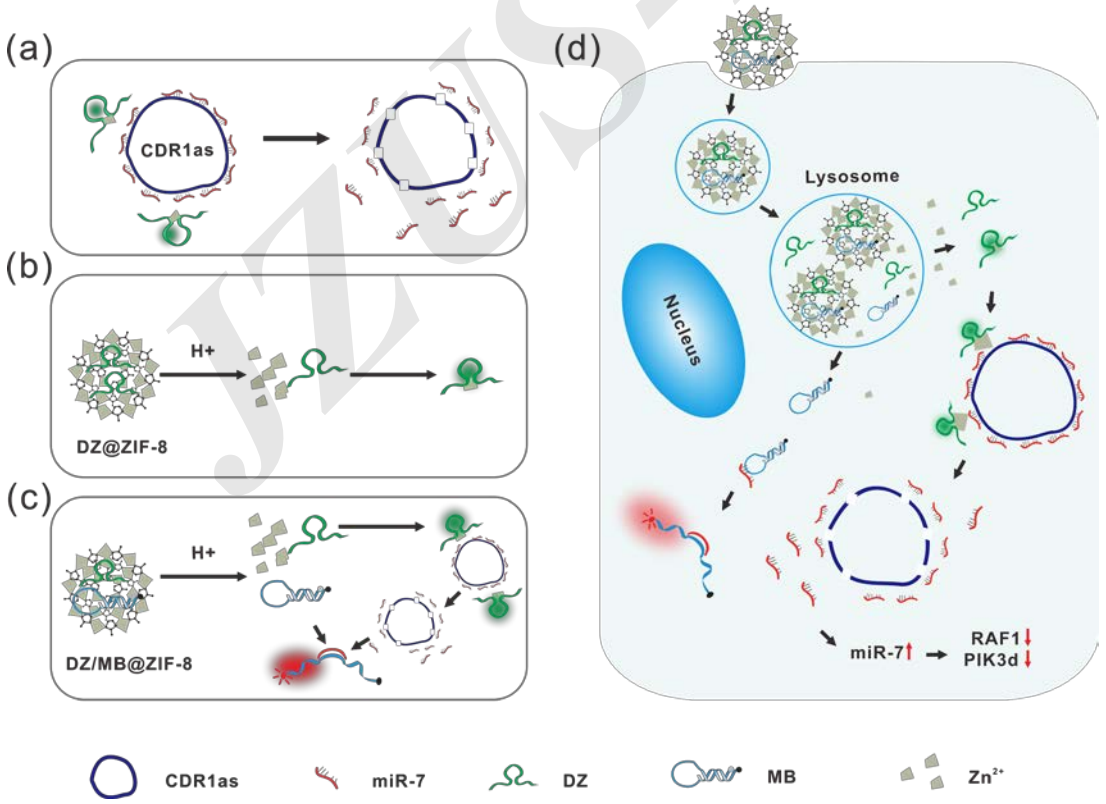
- The circRNA CDR1as functions as an oncogenic sponge for microRNA-7 (miR-7), making it a compelling therapeutic target.
- Current circRNA manipulation tools face limitations such as low intracellular delivery efficiency and complex protein components.
- Traditional methods cannot assess therapeutic effects in real time.



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Design & Innovation

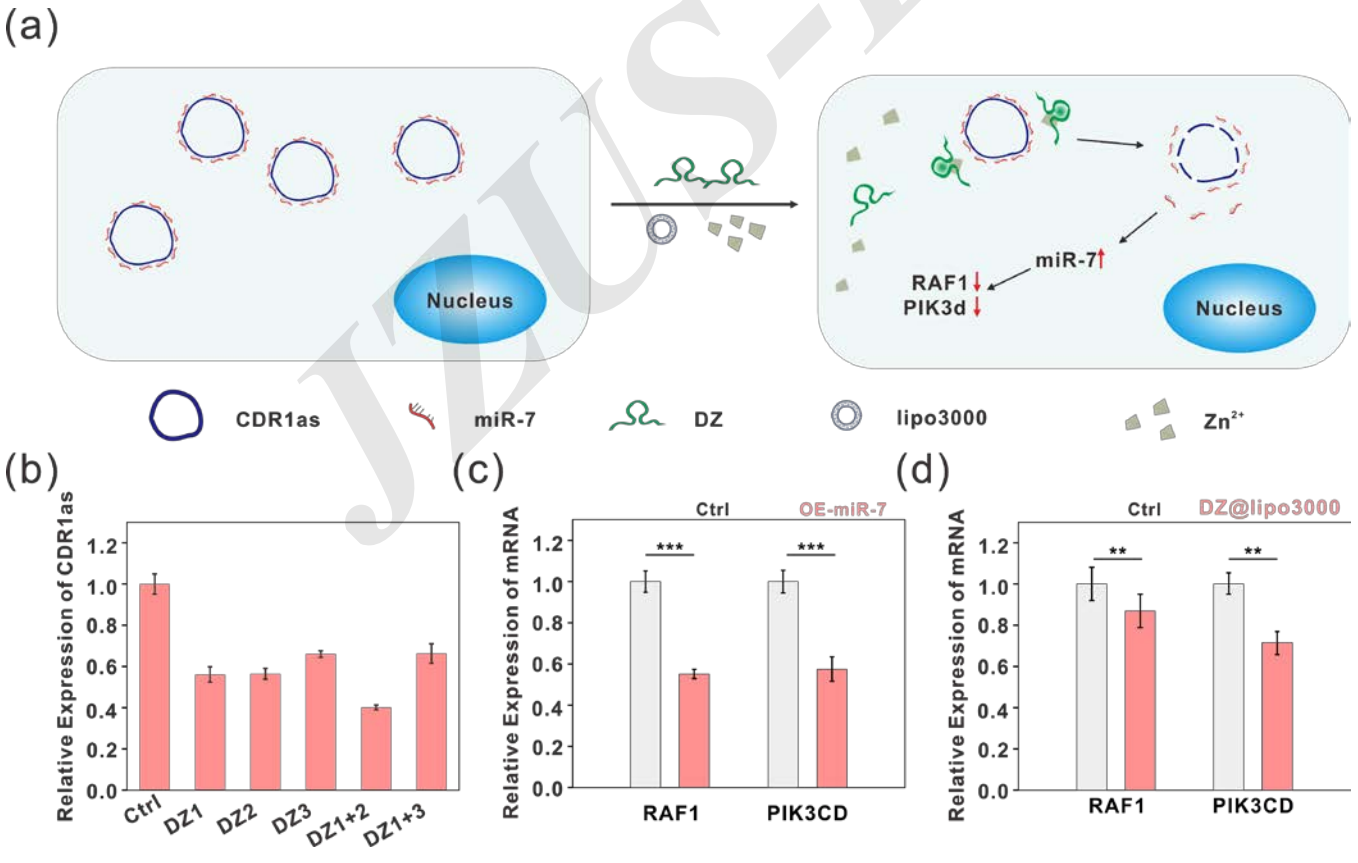
- Developed a novel Zeolitic Imidazolate Framework-8 (ZIF-8)-based nanoplatform DZ/MB@ZIF-8.
- Co-encapsulates DNAzymes for the catalytic cleavage of CDR1as and a molecular beacon (MB) for reporting miR-7 activity.
- Acidic microenvironment triggers disassembly, releasing therapeutic/sensing components and essential Zn^{2+} cofactors for DNAzyme activation.



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Key Result 1 – Efficient Gene Regulation

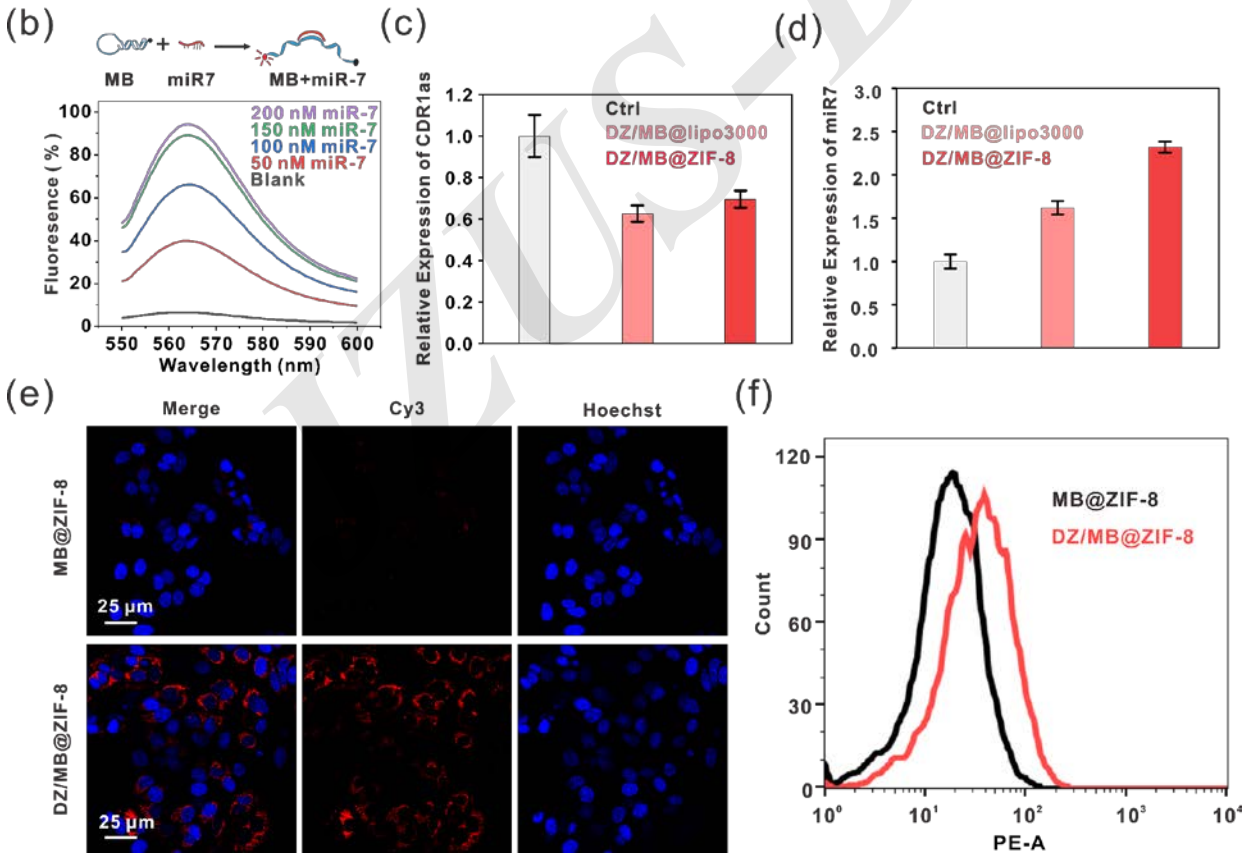
- Demonstrates efficient degradation of CDR1as without the need for external Zn^{2+} supplementation.
- Liberates miR-7 and significantly inhibits the expression of its downstream oncogenic targets, RAF1 and PIK3CD.
- Combined DNAzyme sets (DZ1+2) exhibited synergistic cleavage efficiency.



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Key Result 2 – Real-Time Live-Cell Monitoring

- The therapeutic effect is directly correlated with a turn-on fluorescent signal from the MB.
- Enables real-time, live-cell readout of circRNA regulation.
- Exhibited excellent universality and was successfully applied across multiple cell lines.



Conclusion & Impact

- Establishes a versatile theranostic strategy that merges targeted gene regulation with intrinsic biosensing.
- Offers a powerful platform for probing circRNA function and advancing RNA-centric therapeutics.

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