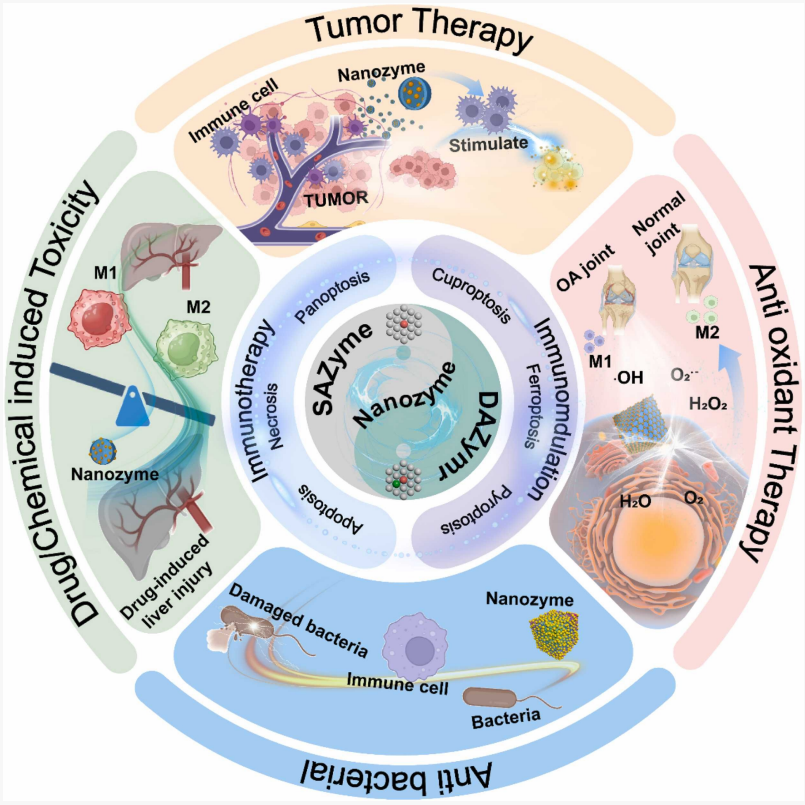
Atomically Engineered Nanozymes for Immunotherapy and Disease Treatment

GA, UNITED STATES, February 3, 2026 /EINPresswire.com/ -- Atomically engineered nanozymes (AENs) combine precise nanotechnology with catalytic functions to enhance immune regulation through atomic-level control. AENs represent a promising frontier for personalized medicine and immune engineering

Published in the KeAi journal Nano Biomedicine and Engineering, a new review by researchers from Hainan Medical University details how atomically engineed nanozymes (AENs)are engineered to mimic natural enzymes while outperforming them in biomedical applications. These nanostructures can precisely regulate reactive oxygen species (ROS), activate immune pathways, and remodel the tumor microenvironment—killing tumors by immunotherapy.



Schematic illustration of recent advances in diagnostic and therapeutic systems based on AENs, including applications in tumor therapy, anti oxidant therapy, anti bacterial therapy

“From radioimmunotherapy and cuproptosis to ferroptosis and pyroptosis, AENs are being harnessed to induce immunogenic cell death, activate STING pathways, and boost checkpoint blockade therapies,” shares senior author Pir Muhammad. “They also show promise in antibacterial applications, wound healing, and mitigating drug-induced organ toxicity.”

In particular, AENs’ atomic tunability allows the design of targeted, efficient, and personalized therapeutic platforms for more effective treatments of different disease, including rheumatoid arthritis, acute pancreatitis, sepsis, Parkinson's disease , ischemic strokes, pneumonia, and Alzheimer's disease.

Nonetheless, the authors note that while AENs show promise, challenges remain in scaling synthesis, long-term biocompatibility, and precise control of catalytic activity in dynamic biological environments. Future efforts are likely to focus on intelligent nanozyme design, real-time immune monitoring, and clinical translation.

References

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