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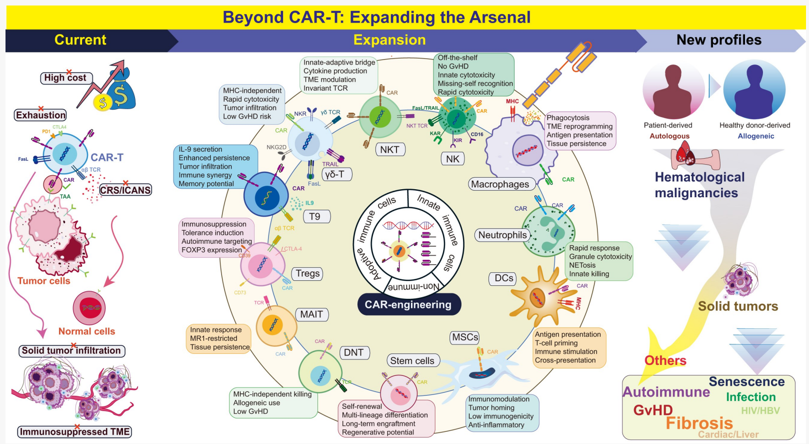
CAR therapy moves beyond cancer

GA, UNITED STATES, April 18, 2026 /EINPresswire.com/ -- Chimeric antigen receptor, or CAR, therapy is no longer just a cancer story. This review shows how the field is expanding beyond conventional CAR-T cells into a wider family of engineered cell platforms, including NK cells, γδ T cells, natural killer T (NKT) cells, mucosal-associated invariant T (MAIT) cells, and double-negative T cells (DNT), regulatory T cells (Tregs), macrophages, dendritic cells, neutrophils, and stem-cell-based systems. Each platform offers different strengths in safety, tissue penetration, persistence, and manufacturing. Together, they could help overcome major barriers that still limit CAR-T therapy, while opening new therapeutic possibilities not only in oncology, but also in autoimmunity, infection diseases, fibrosis, and age-related diseases.



Evolution of CAR technology: from conventional CAR-T cells to diverse cellular platforms and clinical applications.

CAR-T therapy has transformed treatment for some blood cancers, with seven FDA-approved products and strong clinical responses in hematologic malignancies. However, its limitations remain evident. In solid tumors, engineered T cells often struggle with trafficking, persistence, antigen heterogeneity, and the immunosuppressive tumor microenvironment. Toxicities such as cytokine release syndrome and neurotoxicity remain serious concerns, while autologous manufacturing is slow, expensive, and difficult to scale. These shortcomings have pushed researchers to rethink CAR not as a single-cell solution, but as a broader therapeutic platform. Based on these challenges, deeper research into diverse CAR systems is needed.

In a review published on March 13, 2026, in Precision Clinical Medicine, researchers from City of Hope National Medical Center and the University of California, Irvine, outlined how CAR technology is rapidly evolving beyond traditional CAR-T cells. Their analysis covers 13 engineered cell platforms and argues that future progress will depend on matching the right cellular platform to the right disease, potentially extending CAR-based therapy from cancer into autoimmune, infectious, fibrotic, and senescence-related disorders.

The review makes clear that αβ CAR-T cells remain the field's benchmark, with complete remission rates of 40%–85% in relapsed or refractory B-cell acute lymphoblastic leukemia and response rates above 80% in multiple myeloma. Yet the same platform also brings major limitations, including cytokine release syndrome (CRS), immune effector cell–associated neurotoxicity syndrome (ICANS), weak solid-tumor performance, and manufacturing costs that can reach $300,000–$500,000 per patient. That is why researchers are diversifying. CAR-NK cells offer rapid killing and lower risks of GvHD, CRS, and ICANS. CAR-γδ T cells bring natural tumor tropism and allogeneic potential; in an early study of ADI-001 for B-cell malignancies, response rates reached 78% without severe GvHD, CRS, or ICANS. CAR-macrophages may be better suited to solid tumors and fibrosis because they can penetrate tissue, phagocytose targets, and remodel hostile microenvironments. CAR-Tregs, by contrast, are being developed to induce immune tolerance in transplantation and autoimmune disease. The review also highlights next-generation strategies such as off-the-shelf production from donors, HSCs, or iPSCs, in vivo CAR generation, logic-gated designs, and combination therapies that could improve precision, safety, and access.

The authors suggest that the future of CAR therapy may lie in treating it as a modular platform rather than a single cancer technology. In that view, the central question is not whether CAR-T still matters, but which engineered cell type best fits a specific biological problem. A macrophage may be a better fit in fibrosis, a regulatory T cell in autoimmunity, and NK or γδ T cells in faster off-the-shelf applications, as well as the potential for combining multiple cell therapies and integrating them with non-cell-based therapies

The broader significance of this review is strategic as much as scientific. A diversified CAR ecosystem could make cell therapy more precise, more scalable, and more adaptable to real clinical needs. Off-the-shelf products may reduce cost and delay. In vivo engineering may eventually bypass labor-intensive manufacturing. Most importantly, disease-matched CAR platforms could push engineered-cell medicine beyond oncology into lupus, infection, cardiac or liver fibrosis, and senescence-associated disorders. Even so, the authors caution that most alternative platforms remain early in development and will require disease-specific evaluation and long-term safety monitoring before they can reshape routine care.

References
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