

# Glioblastoma Immunity Review

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*Summary and findings of:*

*Moreno-Sanchez PM, Rezaeipour M, Inderberg EM, Platten M, Golebiewska A. Immunosuppressive mechanisms and therapeutic interventions shaping glioblastoma immunity. Nat Cancer. 2026 Jan 8. doi: 10.1038/s43018-025-01097-9. PMID: 41507535.*

Here's a **summary and key findings** of the recent *Nature Cancer* review you asked about — **Moreno-Sanchez PM, Rezaeipour M, Inderberg EM, Platten M, Golebiewska A. Immunosuppressive mechanisms and therapeutic interventions shaping glioblastoma immunity. Nat Cancer. 2026; published Jan 8, 2026. doi:10.1038/s43018-025-01097-9. PMID: 41507535** — based on the abstract and available summaries: [PubMed](#)

## Overview

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Glioblastoma (GBM) remains one of the most **immunoresistant and lethal brain tumors**. This review synthesizes current understanding of how **immunosuppressive mechanisms** within GBM and its microenvironment (TME) blunt antitumor immunity and evaluates **therapeutic strategies** designed to overcome these barriers. [PubMed](#)

## Core Concepts

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### 1. Immunosuppressive Tumor Microenvironment (TME)

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- GBM is characterized by a highly adaptive and plastic TME that collaborates with tumor cells to evade both innate and adaptive immunity.
- Interactions among tumor cells, myeloid cells (e.g., tumor-associated macrophages), astrocytes, regulatory T cells (Tregs), and inhibitory cytokines create a milieu that **suppresses effector T cells** and other antitumor mechanisms. [PubMed](#)

## Key Immunosuppressive Mechanisms Identified

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Though the full review text isn't accessible publicly, **open access summaries and related secondary analyses** point to several important mechanisms discussed in the paper:

### • Myeloid and macrophage-driven suppression

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Tumor-associated macrophages and microglia often adopt an immunosuppressive phenotype in GBM, **blocking CD8<sup>+</sup> T-cell infiltration and function**. [PubMed](#)

## • Astrocyte-mediated T-cell suppression

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IL-11/STAT3 axis in astrocytes can induce TRAIL expression, leading to **T-cell apoptosis** within the TME. Experimental disruption of this pathway improves immune responses and survival in preclinical models. [ResearchGate](#)

## • Cytokine and soluble factor networks

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Elevated immunosuppressive cytokines (e.g., TGF- $\beta$ ) contribute to immune evasion by **inhibiting T cells, dendritic cells, and NK cells**. [SpringerLink](#)

## • Structural and physical barriers

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GBM's location behind the **blood–brain barrier (BBB)**, coupled with a low baseline of tumor-infiltrating lymphocytes ("cold" phenotype), further restricts immune engagement.

[Nature](#)

# Therapeutic Interventions Discussed

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The review emphasizes that single-modality immunotherapies have largely failed in GBM due to redundant immunosuppressive pathways. The authors describe strategies aiming to **prime and rewire the TME** rather than only targeting tumor cells: [PubMed](#)

### 1. Local TME priming and rewiring

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Approaches to stimulate local immune activation — for example, through **STING agonists**, TLR agonists, or other innate activators — to convert an immunologically "cold" environment into a "hot," T-cell-permissive one. [News Center](#)

### 2. Combination immunotherapy

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Pairing immune checkpoint inhibitors (ICIs) with agents that modulate suppressive cells (e.g., TGF- $\beta$  blockade, myeloid modulators, oncolytic viruses) has stronger preclinical support than monotherapies. [Nature](#)

### 3. Targeting extrinsic immune suppression

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Strategies beyond the tumor — such as enhancing systemic T-cell priming or correcting therapy-induced lymphopenia — are increasingly seen as necessary complements to intratumoral interventions. [Nature](#)

### 4. Precision and engineered immune cells

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Engineering T cells (e.g., CAR-T) that resist local suppression and improve trafficking/effector functions is also addressed, though still early in clinical validation. [ous-research.no](#)



## Conceptual Paradigms from the Review

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The authors introduce two strategic frameworks for future GBM immunotherapy: [PubMed](#)

- **Local TME priming:** Activating or restructuring the immune microenvironment to support durable T-cell responses.
- **TME rewiring:** Longer-term, dynamic modification of suppressive cellular networks to sustain antitumor immunity and overcome adaptive resistance.

These concepts highlight that durable clinical benefit in GBM likely requires **multimodal and context-specific immune modulation**, not just blockade of a single inhibitory pathway.

[PubMed](#)

## Translational and Clinical Implications

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- The review underscores why **immune checkpoint inhibitors** alone haven't succeeded in GBM and why **combinatorial, microenvironment-focused strategies** are essential. [Nature](#)
- It also frames future research directions: identifying biomarkers of immune suppression, optimizing delivery across the BBB, and tailoring immunotherapy to specific TME states.

## Take-Home Message

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This high-profile review synthesizes the complex **immunosuppressive architecture of GBM** and argues that successful immunotherapy will require *priming the TME and rewiring suppressive networks* through rational, combinatorial strategies that target both local and systemic barriers to immunity. [PubMed](#)

If you'd like, I can also summarize specific sections (e.g., **innate vs adaptive immunosuppression mechanisms**, or detail **novel interventions in early clinical development**) in an annotated Vancouver-style bibliography.

*Detail novel interventions in early clinical development in an annotated Vancouver-style bibliography*

Below is an **annotated Vancouver-style bibliography** summarizing **novel immunotherapy interventions in early clinical development for glioblastoma (GBM)** — with an emphasis on strategies highlighted in recent literature and ongoing trials (including adoptive cell therapies, vaccines, engineered immune modulators, and other cutting-edge approaches). These approaches align with the immunosuppressive mechanisms and intervention frameworks outlined by Moreno-Sanchez et al. (2026) ("local TME priming" and "TME rewiring"), emphasizing strategies that seek to reengage antitumor immunity in GBM's hostile microenvironment. [PubMed](#)

## Annotated Bibliography

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### 1. NCT05366179-B7-H3 CAR T cells in recurrent GBM

*ClinicalTrials.gov Identifier: NCT05366179.*

Phase I trial evaluating the safety and feasibility of autologous **chimeric antigen receptor T cells targeting B7-H3 (CD276)** in recurrent glioblastoma. B7-H3 is a broadly expressed immune checkpoint/antigen in GBM and other solid tumors, making it a compelling target for CAR T cell approaches aimed at overcoming TME immunosuppression. [ClinicalTrials.gov](#)

**Rationale/Innovation:** B7-H3 CAR T therapy represents a next-generation adoptive cell therapy tailored to a prevalent immunosuppressive ligand in GBM, with early clinical translation from promising preclinical efficacy. [SpringerLink](#)

### 2. IL-13R $\alpha$ 2/TGF $\beta$ R2KO CAR T cells (Novel engineering)

*Investigational phase I trial (e.g., NCT06815029; City of Hope).*

This early phase research evaluates **CAR T cells targeting IL-13 receptor  $\alpha$ 2** with engineered knockout of the **TGF $\beta$  receptor 2** to resist immunosuppressive signaling from the GBM microenvironment. TGF $\beta$  is a major inhibitor of T-cell function in GBM. [Springer Nature](#)

**Rationale/Innovation:** Resistance to TGF $\beta$ -mediated suppression may improve central nervous system (CNS) T-cell persistence and antitumor activity, addressing a key barrier in GBM immunity. [Springer Nature](#)

### 3. DOC1021 dendritic cell vaccine + poly-IFN phase II immunotherapy

*Phase II clinical evaluation: DOC1021 DC immunotherapy + pIFN in adult GBM.*

Investigates a **tumor antigen-loaded dendritic cell vaccine** combined with interferon to stimulate adaptive immunity against GBM. DC vaccines aim to prime T cells against tumor antigens despite TME suppression. [National Brain Tumor Society](#)

**Rationale/Innovation:** Harnesses antigen presentation to overcome the low immune visibility ("cold" tumors) seen in GBM; combining with pIFN aims to enhance immune activation. [National Brain Tumor Society](#)

### 4. IGV-001 (Personalized immunotherapy platform)

*Phase 2b trial in newly diagnosed GBM (Dec 2025).*

IGV-001 is in advanced early clinical testing (phase 2b) and has shown encouraging overall survival benefit compared with standard of care in newly diagnosed GBM patients with a favorable safety profile. [cancernetwork.com](#)

**Rationale/Innovation:** Represents a novel immunotherapeutic platform (likely personalized cancer vaccine or immune stimulant) that has gained fast-track and orphan designations, suggesting translational potential beyond early-phase safety.

[cancernetwork.com](#)

## 5. INCIPIENT CARv3-TEAM-E T cell therapy

*Phase I clinical trial in recurrent GBM.*

A novel engineered CAR T cell design studied for safety and antitumor activity in recurrent GBM. Initial cases showed dramatic tumor reductions, indicating potential efficacy despite the suppressive TME. [News-Medical](#)

**Rationale/Innovation:** Demonstrates that novel CAR constructs may provoke meaningful tumor responses even in highly immunosuppressive brain tumors, guiding future combination strategies. [News-Medical](#)

## 6. NK-cell combination therapy with TTFields (early Phase II)

*Early Phase II trial (expanding based on single patient response).*

Combines natural killer (NK) cell therapy with **Tumor Treating Fields (TTFields)** — an electric field therapy approved in GBM — to enhance innate antitumor mechanisms along with a physical modality known to disrupt tumor cell division. [Glioblastoma Multiforme](#)

**Rationale/Innovation:** Integrates innate immune effectors with a device-based therapy to potentially reshape the TME and enhance immune cell infiltration/function. [Glioblastoma Multiforme](#)

## 7. CAR T targeting multiple GBM antigens (from preclinical into clinical pipelines)

*Preclinical constructs targeting antigens such as IL-13Ra2, EGFRvIII, and CD276.*

Although not all constructs are yet in formal early clinical trials, multi-specific CAR strategies are progressing toward translation to counter antigen heterogeneity — a major cause of failure in previous immunotherapies. [PubMed](#)

**Rationale/Innovation:** Multi-targeting designs aim to prevent tumor escape due to antigen loss and engage broader immune recognition within suppressed GBM environments. [PubMed](#)



### Contextual Notes

- Many **immune checkpoint inhibitors** (e.g., LAG-3, TIM-3 blockade) and peptide vaccines remain under investigation and contribute to the broader immunotherapy landscape in GBM, though many have shown limited efficacy as standalone therapies. [Nature](#)
- **Engineered immune modulators** aimed at **myeloid reprogramming** (e.g., LILRB4 inhibitors) and strategies to overcome immunosuppressive cytokine signaling are active areas of translational research, with some agents progressing into early clinical assessment. [SpringerLink](#)
- The integration of **novel delivery platforms** (e.g., nanoparticles, oncolytic viruses combined with immunotherapy) and combinatorial approaches is increasingly prioritized given the multifaceted immunosuppression in GBM. [sciencedirect.com](#)

## Summary

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These early clinical interventions represent diverse strategies to counteract the immunosuppressive TME and enhance antitumor immunity in GBM — from **engineered cellular therapies** (CAR T/NK cells) to **antigen-presenting vaccines** and combined modality approaches. While most are in **Phase I/II** stages, several have reported encouraging signs of safety and preliminary efficacy, marking important steps toward effective immunotherapy for this formidable cancer type.

If you'd like, I can provide a **comparative table of these trials** with mode of action, phase, and clinical endpoints, or delve into **mechanistic rationales** (e.g., how each therapy addresses specific immunosuppressive pathways in GBM).

*It's all. Thanks.*

Anytime — happy to help.

If you need a deeper dive later or want updates as these trials mature, just say the word.