Review Curr Opin Cell Biol. 2023 Nov 18:85:102279. doi: 10.1016/j.ceb.2023.102279.

Online ahead of print.

Drivers of heterogeneity in the glioblastoma immune microenvironment

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PMID: 37984008 DOI: 10.1016/j.ceb.2023.102279

Abstract

Glioblastoma is the most common and aggressive primary brain tumor, characterized by a highly complex and heterogeneous tumor immune microenvironment (TIME). In this review, we discuss the impact of tumor-intrinsic and tumor-extrinsic drivers that contribute to heterogeneity in the adult glioblastoma TIME, focusing on four main factors: genetic drivers, sex, age, and standard of care therapy. We describe recent insights into how each of these factors affects key aspects ranging from TIME composition to therapy response, with an emphasis on the cross-talk between tumor and immune cells. Deciphering these local interactions is fundamental to understanding therapy resistance and identifying novel immunomodulatory strategies.

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