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Emerging neuroimmune mechanisms in cancer neuroscience

Yingying Huang $^{a\,1}$, Xin Zhou $^{a\,b\,1}$, Jiaqi Liu $^{a\,1}$, Ying Cao $^{a\,} \stackrel{\triangle}{\sim} \boxtimes$, Wei Fu $^{a\,b} \stackrel{\triangle}{\sim} \boxtimes$, Jing Yang $^{a\,c} \stackrel{\triangle}{\sim} \boxtimes$

- ^a School of Life Sciences, Peking University Third Hospital Cancer Center, Center for Life Sciences, State Key Laboratory of Membrane Biology, IDG/McGovern Institute for Brain Research, Peking University, Beijing, 100871, China
- b Department of General Surgery, Peking University Third Hospital, Beijing, 100191, China
- ^c Peking Union Medical College Hospital, Beijing, 100730, China

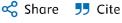
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Highlights

- Cancer neuroscience explores how neural signals influence tumor prognosis.
- Neuroimmune mechanisms represent a key aspect of cancer neuroscience.
- Research promises better therapeutic strategies for cancers and related complications.

Abstract

It has become increasingly recognized that neural signals can profoundly influence the prognosis of various cancer types. In the past years, we have witnessed "cancer neuroscience," which primarily focuses on the complex crosstalk between tumors and neural signals, emerging as a new, multidisciplinary direction of biomedical science. This review aims to summarize the current knowledge of this research frontier, with an emphasis on the neuroimmune mechanisms enacted through the reciprocal interactions between tumors and the central or peripheral nervous system. In addition, we wish to highlight several key questions of cancer neuroscience and its neuroimmune action that warrant future research and translational efforts, including novel strategies for manipulating neural signals for antitumor immunotherapies, as well as managing cancer-related neurological or psychiatric complications.

Section snippets

A brief overview of neuroimmunology

For laying a foundation of detailed discussions in the context of cancers, we briefly outline the key principles of neuroimmunology, which can be generally categorized into two parts, i.e., neuroimmune mechanisms in the central nervous system or in peripheral organs.

(1) Neuroimmunology of the central nervous system (CNS). Maintenance of the CNS functions and homeostasis is facilitated by several immune barriers, including the blood-brain barrier (BBB), the blood-cerebrospinal fluid (CSF) barrier, ...

...

Cancer neuroscience in the CNS

As discussed above, the BBB and other barrier structures effectively separate the CNS from peripheral immune cells and their derived factors. As a result, the immune microenvironment of tumors, either primary or metastatic, residing within the CNS may markedly differ from that of peripheral solid tumors [5,24]. In this section, we will highlight key advances in the knowledge of cancer neuroscience in the CNS, with a focus on gliomas.

Gliomas, which arise from the progenitor cells of astrocytes ...

Cancer neuroscience in peripheral solid tumors

In contrast to the scenario of the CNS, cancer neuroscience in peripheral solid tumors involves neural innervations of sensory, sympathetic, or parasympathetic origin [[53], [54], [55]]. For the purpose of this review, we primarily discuss the involvement of the autonomic nervous system, i.e., sympathetic or parasympathetic innervations, that have been a research focus of the field.

We note that the potential neuroimmune function of sensory signals in peripheral cancers is emerging, to which ...

Future perspectives

Cancer neuroscience has gained broad attention in recent years, reflecting the shared interests and combined efforts of neuro-oncology, neurobiology, and neuroimmunology. Of particular importance, scientific achievements in this emerging multidisciplinary field have promoted the development of novel diagnostic or therapeutic strategies against tumors within the CNS or in peripheral organs. Despite those exciting advances, cancer neuroscience still remains at its nascent stage, with the ongoing ...

CRediT authorship contribution statement

Yingying Huang: Writing – review & editing, Writing – original draft, Investigation. **Xin Zhou:** Writing – review & editing, Writing – original draft, Investigation. **Jiaqi Liu:** Writing – original draft, Investigation. **Ying Cao:** Writing – original draft, Investigation. **Wei Fu:** Writing – review & editing, Writing – original draft. **Jing Yang:** Writing – review & editing, Writing – original draft. ...

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. ...

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