Allomelanin

Allomelanin is a type of pigment that is found in certain organisms, particularly fungi and bacteria. It is a dark-colored substance that is chemically related to melanin, the pigment responsible for the color of human skin, hair, and eyes.

Allomelanin differs from eumelanin, the most common type of melanin found in humans, in terms of its chemical structure and properties. While eumelanin is primarily composed of indole-based polymers, allomelanin contains benzothiazine and benzothiazole units. These units are formed through the oxidation and polymerization of phenolic compounds.

Allomelanin is known for its ability to absorb and dissipate ultraviolet (UV) radiation. This property makes it important for the survival of organisms that produce it, as it helps protect them from the damaging effects of UV light. Additionally, allomelanin has been found to have antioxidant and free-radical scavenging properties, which may contribute to its role in cellular protection.

The exact functions and biological significance of allomelanin are still not fully understood, and research in this field is ongoing. Scientists are investigating its potential applications in various fields, including medicine, materials science, and environmental protection. For example, the UV-absorbing properties of allomelanin make it a promising candidate for the development of sunscreens and protective coatings. Its antioxidant properties also make it an interesting compound for potential therapeutic applications.

Overall, allomelanin is an intriguing pigment with unique properties that continue to be explored by scientists.

Immune checkpoint blockade (ICB) therapy has shown great potential in the treatment of malignant tumors, but its therapeutic effect on glioblastoma (GBM) is unsatisfactory because of the low immunogenicity and T cell infiltration, as well as the presence of blood-brain barrier (BBB) that blocks most of ICB agents to the GBM tissues. Herein, we developed a biomimetic nanoplatform of AMNP@CLP@CCM for GBM-targeted photothermal therapy (PTT) and ICB synergistic therapy by loading immune checkpoint inhibitor CLP002 into the allomelanin nanoparticles (AMNPs) and followed by coating cancer cell membranes (CCM). The resulting AMNP@CLP@CCM can successfully cross the BBB and deliver CLP002 to GBM tissues due to the homing effect of CCM. As a natural photothermal conversion agent, AMNPs are used for tumor PTT. The increased local temperature by PTT not only enhances BBB penetration but also upregulates the PD-L1 level on GBM cells. Importantly, PTT can effectively stimulate immunogenic cell death to induce tumor-associated antigen exposure and promote T lymphocyte infiltration, which can further amplify the antitumor immune responses of GBM cells to CLP002-mediated ICB therapy, resulting in significant growth inhibition of the orthotopic GBM. Therefore, AMNP@CLP@CCM has great potential for the treatment of orthotopic GBM by PTT and ICB synergistic therapy. STATEMENT OF SIGNIFICANCE: The effect of ICB therapy on GBM is limited by the low immunogenicity and insufficient T-cell infiltration. Here we developed a biomimetic nanoplatform of AMNP@CLP@CCM for GBM-targeted PTT and ICB synergistic therapy. In this nanoplatform, AMNPs are used as both photothermal conversion agents for PTT and nanocarriers for CLP002 delivery. PTT not only enhances BBB penetration but also upregulates the PD-L1 level on GBM cells by increasing local temperature. Additionally, PTT also induces tumor-associated antigen exposure and promotes T lymphocyte infiltration to amplify the antitumor immune responses of GBM cells to CLP002-mediated ICB therapy, resulting in significant growth inhibition of the orthotopic GBM. Thus, this nanoplatform

holds great potential for orthotopic GBM treatment [1)]

1)

Sun M, Li Y, Zhang W, Gu X, Wen R, Zhang K, Mao J, Huang C, Zhang X, Nie M, Zhang Z, Qi C, Cai K, Liu G. Allomelanin-based biomimetic nanotherapeutics for orthotopic glioblastoma targeted photothermal immunotherapy. Acta Biomater. 2023 May 24:S1742-7061(23)00300-8. doi: 10.1016/j.actbio.2023.05.037. Epub ahead of print. PMID: 37236575.