Immune cell

A cell that is part of the immune system and helps the body fight infections and other diseases. Immune cells develop from stem cells in the bone marrow and become different types of white blood cells.

Granulocytes include basophils, eosinophils, and neutrophils. Basophils and eosinophils are important for host defense against parasites. They also are involved in allergic reactions.

Microglia are the brain's resident immune cells and function as the main defense against pathogens or injury. However, in the absence of disease, microglia have other functions in the normal brain.

Host immune cells interact bi-directionally with their extracellular matrix (ECM) to receive and deposit molecular signals, which orchestrate cellular activation, proliferation, differentiation, and function to maintain healthy tissue homeostasis. In response to pathogens or damage, immune cells infiltrate diseased sites and synthesize critical ECM molecules such as glycoproteins, proteoglycans, and glycosaminoglycans to promote healing. When the immune system misidentifies pathogens or fails to survey damaged cells effectively, maladies such as chronic inflammation, autoimmune diseases, and cancer can develop. In these conditions, it is essential to restore balance to the body through modulation of the immune system and the ECM. This review details the components of dysregulated ECM implicated in pathogenic environments and therapeutic approaches to restore tissue homeostasis. We evaluate emerging strategies to overcome inflamed, immune inhibitory, and otherwise diseased microenvironments, including mechanical stimulation, targeted proteases, adoptive cell therapy, mechanomedicine, and biomaterial-based cell therapeutics.

Aghlara-Fotovat et al. highlighted various strategies that have produced efficacious responses in both pre-clinical and human trials and identify additional opportunities to develop next-generation interventions. Significantly, they identify a need for therapies to address dense or fibrotic tissue for the treatment of organ tissue damage and various cancer subtypes. Finally, they concluded that therapeutic techniques that disrupt, evade, or specifically target the pathogenic microenvironment have a high potential for improving therapeutic outcomes and should be considered a priority for immediate exploration. A schematic showing the various methods of extracellular matrix disruption/targeting in both fibrotic and cancerous environments. a Biomaterial-based cell therapy can be used to deliver anti-inflammatory cytokines, chemotherapeutics, or other factors for localized, slow release of therapeutics. Mechanotherapeutics can be used to inhibit the deposition of molecules such as collagen that affect stiffness. Ablation of the ECM and target tissue can be accomplished via mechanical degradation such as focused ultrasound. Proteases can be used to improve the distribution of therapies such as oncolytic virus. Localization of therapeutics such as checkpoint inhibitors can be improved with the targeting of specific ECM components, reducing off-target effects and toxicity [1)].

1)

Aghlara-Fotovat S, Nash A, Kim B, Krencik R, Veiseh O. Targeting the extracellular matrix for immunomodulation: applications in drug delivery and cell therapies. Drug Deliv Transl Res. 2021 Jun 26. doi: 10.1007/s13346-021-01018-0. Epub ahead of print. PMID: 34176099.