Immunoregulatory cell

Immunoregulatory cells are a diverse group of cells that play a crucial role in modulating the immune system's responses. These cells help maintain immune homeostasis by balancing the activation and suppression of immune reactions, preventing excessive inflammation, and contributing to immune tolerance.

Here are some key types of immunoregulatory cells:

Regulatory T cells (Tregs):

B Regulatory Cells (Bregs):

Function: Bregs are a subset of B cells that produce anti-inflammatory cytokines and contribute to immunoregulation. They can suppress excessive immune responses and promote tolerance. Markers: CD19+, CD24hi, CD38hi, IL-10-producing B cells. Myeloid-Derived Suppressor Cells (MDSCs):

Function: MDSCs are a heterogeneous population of immature myeloid cells that suppress immune responses. They play a role in regulating inflammation and preventing immune-mediated tissue damage. Markers: CD11b+, Gr-1+, heterogeneous population. Macrophages:

Function: Macrophages have diverse functions, including phagocytosis, antigen presentation, and cytokine production. Depending on their activation state, macrophages can exhibit pro-inflammatory or anti-inflammatory properties. Markers: CD14+ (in humans), F4/80+ (in mice). Dendritic Cells (DCs):

Function: DCs are professional antigen-presenting cells that play a critical role in initiating and regulating immune responses. Depending on their maturation state, DCs can either promote tolerance or activate immune responses. Markers: CD11c+, MHC II+. Natural Killer T Cells (NKT cells):

Function: NKT cells have both innate and adaptive immune features. They can regulate immune responses by producing cytokines and interacting with other immune cells. Markers: Variable, often express both T cell and NK cell markers (e.g., CD3+, CD56+). Mesenchymal Stem Cells (MSCs):

Function: MSCs have immunosuppressive properties and can modulate the function of various immune cells. They are being investigated for their therapeutic potential in immune-related disorders. Markers: CD73+, CD90+, CD105+, lack hematopoietic markers. Regulatory Natural Killer (NK) Cells:

Function: Regulatory NK cells can produce anti-inflammatory cytokines and interact with other immune cells to modulate immune responses. Markers: Variable, may express CD56 and CD16. Immunoregulatory cells are essential for maintaining a balanced immune system, preventing autoimmune reactions, and resolving inflammation. Dysregulation of these cells can contribute to the development of autoimmune diseases, chronic inflammation, and other immune-related disorders. Research in this field is ongoing, and understanding the functions and interactions of immunoregulatory cells is critical for advancing therapeutic strategies in various immune-mediated conditions.

Skin wounds significantly impact the global health care system and represent a significant burden on the economy and society due to their complicated dynamic healing processes, wherein a series of immune events are required to coordinate normal and sequential healing phases, involving multiple immunoregulatory cells such as neutrophils, macrophages, keratinocytes, and fibroblasts, since dysfunction of these cells may impede skin wound healing presenting persisting inflammation, impaired vascularization, and excessive collagen deposition. Therefore, cellular target-based immunomodulation is promising to promote wound healing as cells are the smallest unit of life in immune response. Recently, immunomodulatory hydrogels have become an attractive avenue to promote skin wound healing. However, a detailed and comprehensive review of cellular targets and related hydrogel design strategies remains lacking.

He et al. reviewed, the roles of the main immunoregulatory cells participating in skin wound healing are first discussed, and then we highlight the cellular targets and state-of-the-art design strategies for immunomodulatory hydrogels based on immunoregulatory cells that cover defect, infected, diabetic, burn and tumor wounds and related scar healing. Finally, they discuss the barriers that need to be addressed and future prospects to boost the development and prosperity of immunomodulatory hydrogels [1)]

1)
He Y, Cen Y, Tian M. Immunomodulatory hydrogels for skin wound healing: cellular targets and design strategy. J Mater Chem B. 2024 Jan 29. doi: 10.1039/d3tb02626d. Epub ahead of print. PMID: 38284157.