

“Macrophage-centered Host Response to Biomaterials and Wound Healing”

S. F. Badylak, DVM, PhD, MD

Adult mammalian wound healing has been studied for many centuries and the classic paradigm includes processes of hemostasis, inflammation, and scar tissue formation. Very few tissues in adult mammals have the capacity for true regeneration, such tissues being limited to the mucosal lining of the intestine, the liver, bone marrow, and certain layers of the epidermis. Most other tissues respond to injury with the eventual formation of scar tissue. Significant advancements have been made in hemostasis, surgical technique, and pharmacologic manipulation of the inflammatory cascade; however, there have been few if any discoveries that fundamentally change the process of inflammation toward true tissue regeneration.

The macrophage is a central figure in the inflammatory cascade. This long studied cell has been traditionally been considered to play a role in phagocytosis, destruction of infectious agents, isolation of foreign materials, and paracrine effects. Macrophages have received renewed attention in recent years as it has become evident that the potential of these cells for participation in stem and progenitor cell recruitment, tissue rebuilding, and tissue homeostasis have been identified. With regard to implantable biomaterials, the clinical success is ultimately determined by the host response to the material. The central role of the macrophage suggests that improved understanding of the role of this cell type and manipulation of that role can be utilized for significant clinical benefit. It is possible that encouragement of macrophage participation in constructive remodeling; rather than suppression of macrophage activity can lead to a fundamental change in the host wound healing response toward constructive tissue remodeling/epimorphic regeneration.