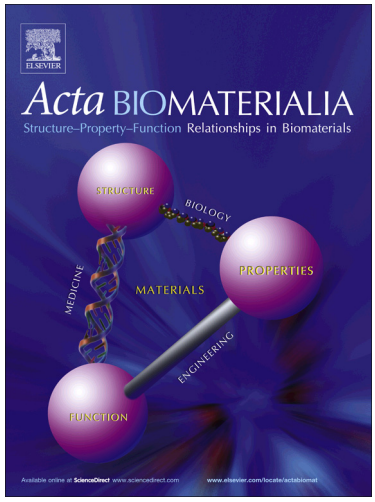

Review article

Therapeutics Incorporating Blood Constituents

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Therapeutics Incorporating Blood Constituents

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Abstract

Blood deficiency and dysfunctionality can result in adverse events, which can primarily be treated by transfusion of blood or the re-introduction of properly functioning sub-components. Blood constituents can be engineered on the sub-cellular (i.e., DNA recombinant technology) and cellular level (i.e., cellular hitchhiking for drug delivery) for supplementing and enhancing therapeutic efficacy, in addition to rectifying dysfunctioning mechanisms (i.e., clotting). Herein, we report the progress of blood-based therapeutics, with an emphasis on recent applications of blood transfusion, blood cell-based therapies and biomimetic carriers. Clinically translated technologies and commercial products of blood-based therapeutics are subsequently highlighted and perspectives on challenges and future prospects are discussed.

Keywords

Blood substitutes; Blood mimicry; Blood cell-derived; Blood transfusion; Biomimetic; Drug delivery

Introduction

Bloodletting likely originated in ancient Egypt, as it was thought the act removed the illness [1]. Leeches have been used to help facilitate the bloodletting process [2]. In regards to blood transfusion, the first occurred around 1630 and the first successful blood transfusion was accomplished in 1665 in England. Blood transfusions are helpful for replacing needed red blood cells (RBC)s, for delivering anti-thrombotic clotting therapeutics and neutralizing antibodies. Before the 1970s past, risks of transfusion involved infectious diseases [3] such as hepatitis B/C or HIV, and risks for cancer [4] (i.e., non-Hodgkin lymphoma (NHL) [5] and leukemia). With today's technology, the probability of having issues with blood transfusions involving blood typing, and Rh compatibility is highly unlikely when using appropriate measures. For example, the probability of contracting HIV is approximately 1 in 1 million [6]. Today, the following are generally screened for protecting transfusion recipients: HIV, hepatitis B, hepatitis C, human T-lymphotropic virus, syphilis, ABO/RhD, and other antibodies (i.e., against cytomegalovirus (CMV), hemoglobin (Hb)s, malaria).

In addition to replacing or supplementing blood and its components due to blood deficiencies and dysfunctionality, blood can be manipulated to exert supplemental therapeutic action or used to aid medical treatments, which are unrelated to natural blood-related mechanisms. This review will discuss: (1) blood-based therapeutics which serve as oxygen delivery vectors; (2) blood constituents which have an intrinsic therapeutic effect itself (i.e., clotting or immune supplementing (non-cell-based)); (3) cell