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Novel engineering: Biomimicking erythrocyte as a revolutionary platform for drugs and vaccines delivery

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Abstract

Over the years, extensive studies on erythrocytes, also known as red blood cells (RBCs), as a mechanism for drug delivery, have been explored mainly because the cell itself is the most abundant and has astonishing properties such as a long life span of 100–120 days, low immunogenicity, good biocompatibility, and flexibility. There are various types of RBC-based systems for drug delivery, including those that are genetically engineered, non-genetically engineered RBCs, as well as employing erythrocyte as nanocarriers for drug loading. Although promising, these systems are still in an early development stage. In this review, we aimed to highlight the development of biomimicking RBC-based drug and vaccine delivery systems, as well as the loading methods with illustrative examples. Drug-erythrocyte associations will also be discussed and highlighted in this review.

We have highlighted the possibility of exploiting erythrocytes for the sustained delivery of drugs and vaccines, encapsulation of these biological agents within the erythrocyte or coupling to the surface of carrier erythrocytes, and provided insights on genetically- and non-genetically engineered erythrocytes-based strategies.

Erythrocytes have been known as effective cellular carriers for therapeutic moieties for several years. Herein, we outline various loading methods that can be used to reap the benefits of these natural carriers. It has been shown that drugs and vaccines can be delivered via erythrocytes but it is important to select appropriate methods for increasing the drug encapsulated or conjugated on the surface of the erythrocyte membrane. The outlined examples will guide the selection of the most effective method as well as the impact of using erythrocytes as delivery systems for drugs and vaccines.