Chapter 14
SecureStem Software for Optimized Stem Cell Banking Management

Asmita Yadav
Jaypee Institute of Information Technology, India

Cyrus Thapa
Jaypee Institute of Information Technology, India

Nipun Garg
Jaypee Institute of Information Technology, India

Om Verma
Jaypee Institute of Information Technology, India

ABSTRACT

In the current era, fraudulent activities in stem cell banking have risen, exploiting vulnerable patients. Some banks transfer stem cells without transparency. Blockchain tackles this by ensuring secure transactions. A smart contract-driven agent verifies blockchain blocks, boosting transparency. Blockchain digitizes stem cell transactions, ensuring accessible records. This initiative optimizes stem cell supply chain management by tracking specific blocks and their transaction history. The authors can swiftly allocate stem cells to patients, offering timely accessibility and a clear advantage to those in need.

1. INTRODUCTION

Stem cells are fundamental building blocks within the body, serving as the origin from which all specialized cells are formed (Brown et al., 2019). Given the right conditions, either within the body or in a controlled laboratory setting, stem cells divide and give rise to additional cells known as daughter cells (Larsson, 2019; Shah and Jani, 2018). Stem cells originate from four primary sources: embryonic tissues, fetal tissues, adult tissues, and reprogrammed differentiated somatic cells, recognized as induced

DOI: 10.4018/979-8-3693-3502-4.ch014

pluripotent stem cells (iPSCs). Notably, a valuable yet often overlooked source is umbilical cord blood stem cells from newborns. These stem cells, abundant in the placenta and umbilical cord blood after birth, can be harvested and preserved for potential stem cell transplantation (Martin et al., 2008; Murdoch et al., 2020; Betsou, 2017). Stem cells play a pivotal role in addressing the consequences of aging, injury, or illness, as they possess the capacity to replace or repair damaged components of the body, thus restoring normal function. Particularly, umbilical cord blood stem cells exhibit strong regenerative capabilities and are effective in treating more than 80 diseases (Sverige, 2017) These cells can mature into blood cells to replace unhealthy ones.

Umbilical cord blood banking holds immense potential due to its ability to treat conditions like cancers (such as lymphomas and leukemia), genetic disorders, and metabolic and immune disorders (Dricu, 2018). Medical professionals worldwide advocate for umbilical cord blood banking during childbirth.

Varieties of stem cell banks exist in India:

- Privately-owned stem cell banks
- Government-operated (public) stem cell banks
- Community-oriented stem cell banks

Prominent Stem Cell Banks in India:

- LifeCell International Pvt. Limited
- Reliance Life Sciences Pvt. Limited
- Ree Laboratories Pvt. Limited

Securing high-quality stem cells constitutes a significant hurdle in stem cell banking. The cells must be derived from healthy, disease-free tissues and must undergo proper processing and storage to retain their potency (Dunn, 2004). Another challenge pertains to accessibility, as private stem cell banks may be financially unfeasible for some individuals, while public banks might struggle to meet the escalating demand for stem cells.

1.2 How Blockchain Helps in Stem Cell Banking

In the era of the digital economy, everyone is forced to convert to a digital transaction and payment modes. Though it has many merits to its list, there is a critical element called security which is a significant concern for both the service provider and the end-use (Kapferer, 2008; Institutet, 2016). But technological development gave solutions for the problem through the Blockchain method.

In our project we will Maintain all the health record digitally with the help of blockchain.

This will help in making the healthcare more equitable and Transparency of the clinical trials will also be increased. A basic framework of blockchain is shown in Figure 1.

If the stem-cell donor is willing to store his/her stem cells in a hospital or bank for preservation and future use, he or she can do so, but the problem arises when the bank denies that there are any stem cells present physically in the donor. Now the issue appears: filing the petition to claim his or her stem cells' value. This process of claiming the preservation of stem cells can be very hectic, time consuming, and ambiguous. Our work is focused on-