Will Blockchain Technology Transform Healthcare and Biomedical Sciences?

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Abstract

With the rise of technology, modern healthcare and biomedical sciences have largely shifted their content to cyberspace. This raises the challenges of accessibility and security of such data, and the solution may lie in a recent technology called blockchain. Blockchain is a public transaction ledger that offers two unique capabilities, immutability and decentralization of data, that make it stand out as an unparalleled technology in the spheres of healthcare and biomedicine.

Keywords: Blockchain; Data Accessibility; Data Security; Healthcare; Biomedicine

Blockchain is the invisible technology transforming our world. Invented by Satoshi Nakamoto in 2008 to serve as the public transaction ledger of the cryptocurrency bitcoin [1], blockchain has rapidly asserted its influence in every modern industry-finance, government, smart appliances, and now healthcare and biomedical sciences. In simple terms, a blockchain is an open transaction ledger that allows new information to be appended but prevents previous information from being changed. It is composed of a growing chain of blocks linked by cryptography, where each block becomes immutable once it is chained, and the blocks are viewable to anyone with access. This setup is what makes blockchain an efficient and secure system for decentralized transactions.

One promising application of blockchain technology is toward data accessibility and security in the healthcare industry. A patient's private medical data often needs to be shared between multiple healthcare providers as well as be available to the patient. With the rise of technology in recent decades, healthcare records have largely shifted to cyberspace to facilitate storage and increase accessibility for healthcare providers and patients.

However, with this development comes the threat of data breaches, a devastating problem in terms of both patient privacy and monetary loss. A recent article published by Forbes cited that the healthcare industry suffers a loss of about $380 per single compromised patient record [2]. Consequently, we need a secure and efficient method for the storage and transmission of such data in the form of blockchains.

Storing medical data in blockchains provides several advantages, including allowing the data to be stored as a consolidated record accessible by multiple healthcare providers and the patient. This provides an efficient means of distributing the medical record, e.g. when a patient is transferred from one medical institution to another. Furthermore, once the patient record is in the system, only new information can be added; existing information cannot be altered. This change-tracking system is critical in healthcare, as it is essential that all updates to the records are traceable, e.g. if a patient is administered medications multiple times. Finally, all the medical data within the blockchain system are encrypted and thereby shielded from any potential data breach. Personal healthcare information is extremely sensitive and must be highly protected, and blockchain provides the necessary level of security.

Apart from the potential benefits, there still exist several challenges that the blockchain industry must address. The cost of initially setting up a complete operating system of blockchains is extremely expensive, and in addition, the specialized hardware and personnel training require further monetary spending, so summing up to a sizable total cost. Another risk is the lack of regulation and governance of blockchain technology. Because the system is decentralized, there is no central authority that can assume responsibility for any of the transactions that occur [3].

Nonetheless, even in the face of obstacles, the blockchain healthcare sector has experienced a tremendous boom in recent times. In the past six months alone, the number of projects covering areas with decentralized health records and data marketplaces "has tripled in size, covering nearly 150 projects that have raised more than $660 million in private and blockchain-funded (crypto) markets," according to STAT [4]. ALLIVE is one such project tackling the difficulties in healthcare by creating a comprehensive healthcare services system that runs on blockchain.

According to the project website, ALLIVE will "build a private profile of an individual's health data, operate as an artificial intelligence healthcare provider, and connect everything together in a comprehensive healthcare service system," all using blockchain technology [5]. Beyond this comprehensive feat, countless other companies are also turning to blockchain for a variety of healthcare services. Nebula Genomics uses blockchain technology to enhance accessibility and protection of genomic data [6], doc.ai applies blockchain to precision medicine [7] and Chronicled uses blockchain to provide transparency in the pharma supply chain [8], among others. All of these projects contribute to the recent surge in blockchain application toward a better healthcare system for society.

Blockchain is applicable not only directly to the healthcare system, but also to the underlying biomedical science research itself. The easy accessibility of block data fosters an open science environment, where researchers can collaborate on a consolidated database of information regarding drug development, clinical research trials, etc. Consequently, this also leads to improved quality control for the science conducted, as researchers have the opportunity to test research reproducibility and diminish counterfeit drugs in the pharmaceutical industry. In an effort to address these solutions, Icahn School of Medicine at Mount Sinai launched a biomedical blockchain research center in 2018, joining the force of blockchain in biomedicine [9].

Although blockchain still faces many challenges in its nascent stage, its extraordinary capabilities make it stand out as an unparalleled technology that promises to transform healthcare and biomedical sciences.

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