

# X GENOMICS

## WHITEPAPER



# HUMAN VARIANT GENOME PROJECT

Genome Blockchain Scheme

V 1.0

# CONTENTS

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## Preface

## Background

- Technical Architecture of X Genomics
- Problems and Issues Arising From the Human Genome Project
- The Current Status of Gene Sequencing Industry
- Opportunities and Challenges in the Gene Sequencing Industry

## The Goal and Scheme of X Genomics

- The Goal of X Genomics
- Human Variant Genome Project
- Secure and Reliable Genetic Data Collaboration System
- Open and Transparent Sharing Service Platform

## Technical Architecture of X Genomics

- Overall Architecture
- Consensus Mechanism
- The Constitution of Witnesses
- Data Security
- The Security of Data Network
- Multiple Encryption
- Tamper-resistant Data
- Privacy Protection
- Data Desensitization
- Data-leak Prevention

# CONTENTS

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## Certification and Supervision

- Data Ownership and Supervision
- Cross-chain Transactions

## Application Scenarios

- Construction of a Secure Genetic Storage Database
- Study of Gene and Rare Diseases
- Precision Medicine and Disease Prevention
- The Impact of HVGC on the Development of Society

## Business Model

- The Issuance of GSX Tokens
- The Circulation and Distribution of GSX Tokens
- The Distribution Scheme of GSX Tokens

## Organization

- Human Genomic Research Foundation LTD

## Milestone Plan

## Appendix

- Appendix 1 Cautions and Risks
- Appendix 2 Legal Disclaimer



In the year when Melinda and I set up our Foundation, President Clinton summoned some of the world's greatest scientists at the White House and announced a project which can be deemed as a great milestone in the human history. Two competing projects, one led by the National Institutes of Health and the other by a private company, completed the first draft of the human genome atlas. "Undoubtedly, this is the most important and extraordinary step that humankind has ever taken." Clinton said.

16 years later..... We now have the ability to edit the human genome.

----- Commented by Bill Gates on the book of The Gene: An Intimate History

The Human Genome Project revealed the nature of human bioinformatics and gave human beings a powerful weapon to study the various health issues of human life. In the process of studying and finding the solutions, it was found that the difference between individuals accounts for less than 1% of the length of the whole genome, which gives human beings very little information for study and analysis. Therefore, for most health problems, human beings are still at a loss about what to do with them. Human beings know very little about the genetic nature of these problems.

Scientists conducted scientific research to explore genetic and molecular mechanisms; scientific research institutions conducted validation on the susceptibility models by choosing 2000 gene samples from 2000 different people, conducting a Genome Wide Association Study (GWAS) and publishing articles in such magazines as Nature Genetics with an aim to reveal the



universal law of humankind through these 2000 different people's gene samples; the commercial organizations, based on the different GWAS results, built disease prediction models and collected samples like saliva, trying to tell people whether they need to amputate their breasts, like Angelina Jolie, if they have a high probability of suffering from a hereditary disease in the future.

All the data is fragmented and isolated, and now two scientific institutions or commercial institutions are willing to exchange their sequencing information. We have found that except for the Human Genome Project, humanity has never encouraged, nor made a concerted effort to organize countries all over the world to work together in an unanimous exploration of the deeper mysteries of the human genome. The reason for this is not because humanity is inconsistent or does not want to move forward, but because the time and the international environment has changed. The competition between countries, the development of science and technology, and the change of the geopolitical landscape make it difficult for humans to unify together. Even the United Nations is incapable of solving many issues. It is hard to imagine that mankind is unwilling to unite to carry out a project that took human beings countless resources and hundreds of millions of US dollars to complete a few decades ago, but now requires only \$1,000 US, to explore the fate of humankind.

If we regard everyone as a gene unit, then the whole of humanity is a large



collection of different genetic units. This collection is very simple, with a similarity of more than 99.9% between each gene unit and only a few variations. But this collection is also incredibly complex, and no two gene units are the same. The differences in these mutations determine our external appearance, disease, lifespan, physical ability, intelligence, skin color, and so on. Humans are like an ant colony without a queen. Under the laws of heredity, this huge genetic collection mutates continually. It keeps moving forward on a long and dreaded timeline, quietly mutating without being detected by individuals.



## X Genomics Human Variant Genome Project

The original focus of the Human Variant Genome Project (hereinafter referred to as X Genomics) is not on the 99.9% similarity in the genome, but on the 0.1% difference, which is the area of variation.

X Genomics is not a time-limited project with a fixed time and task goal. X genomics is a dynamic project. With the updating of the time and data, it has no time limit, and instead, it will last forever unless human beings become extinct.



Blockchain Technology is abbreviated as BT, also known as distributed ledger technology. Its characteristic is decentralized, open and transparent, so that everyone can participate in database records. Blockchain technology has brought a great deal of change to the era of digital economy and the life sciences. When the two most important technological revolutions of the most recent and current centuries collide, we believe that we are doing a great thing.

Blockchain technology is a natural antidote to the various problems arising from the Human Genome Project.

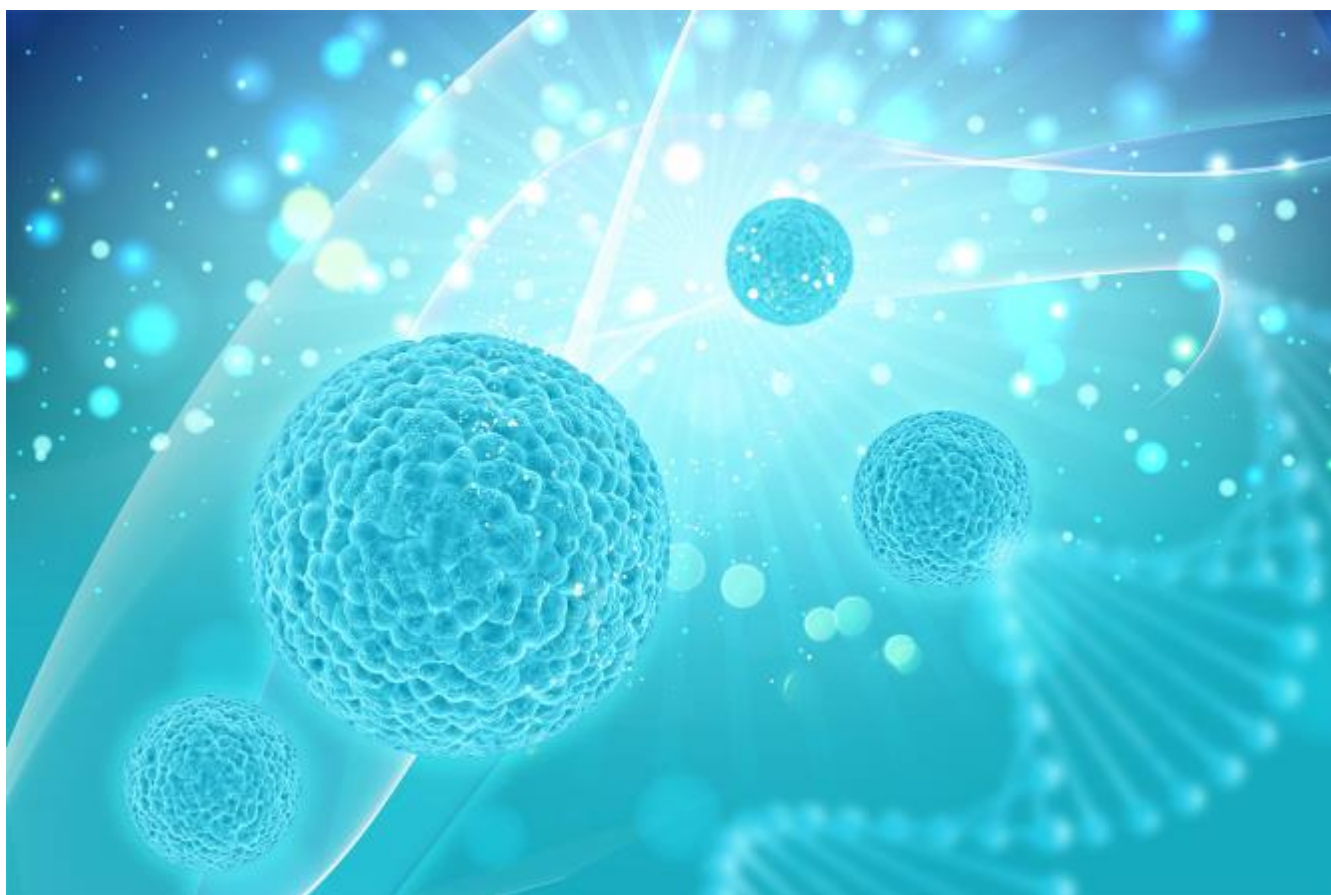
The implementation of our X Genomics project can bring changes as follows. Without spending another \$5 million to collect 2,000 data statistics, the research institutions can publish a high-level paper and collect better data. Pharmaceutical companies can gain a lot of benefits from this project, as they can collect a certain type of shared data from the blockchain anytime, which greatly helps them save a large amount of R&D cost. The medical examination agencies can help users upload their medical examination data to the blockchain and teach users how to protect their privacy. The manufacturers of wearable devices also can gain a new source of profit. Individual users are no longer free data mice, as they are now free to decide which data to sell to research institutions or companies. Genetic detection service companies will be activated again, and the data is truly valuable on the chain.





National government agencies or the United Nations can study the changing patterns of human variant genes, guide epidemics, predict genetic changing trends, and prevent genetic disasters.

Let's be ready to witness the greatest events of the 21st century brought by our X Genomics project, the application of blockchain technology into the human variant genome study.







## The Far-reaching Impact of the Human Genome Project on the Society

The Human Genome Project (HGP) was jointly conducted by scientists from the United States, Britain, France, Germany, Japan and China. It is known as one of the three major scientific programs, the other two being the Manhattan Atomic Bomb Program and Apollo Program, but its influence on human beings is much more profound than that of the other two programs.

The purpose of the Human Genome Project was to determine the sequence of 3 billion base pairs

of the human genome, find all human genes and locate their locations on the chromosomes so as to decipher all the human genetic information. The Human Genome Project led to new medical and biological revolutions. In the medical field, there appear a lot of newly-emerging biological technologies such as genetic engineering, cell engineering, biological chip. The wide application of these new biological technologies in the medical field greatly reshaped the traditional pharmaceutical industry, whose focus was not put only on the treatment of disease as before but also on gene diagnosis and prevention, thus opening the door to the world of personalized and precise medicine.



## The Far-reaching Impact of The Human Genome Project on the Society

For instance, as for single gene diseases, Positional Cloning or Positional Candidate Cloning techniques led to the discovery of a series of disease-causing genes of single-gene genetic diseases such as Huntington's disease, hereditary colon cancer and breast cancer, and laid a solid foundation for the gene diagnosis and therapy for these diseases.

The Human Genome Project interpreted the secrets of the human genome, promoted the rapid development of medical science, medical and health industries, caused a radical change to the life science and biological industry, promoted the innovation of sequencing technology, accelerated scientific discovery and industrial transformation, and realized the breakthrough of the big-data-oriented big science and big industry. Therefore, the impact of the Human Genome Project is much more profound than that of Moore's Law. It can be deemed as a Super Moore's Law.



## Problems and Issues Arising from the Human Genome Project

The Human Genome Project was an important step for human beings to explore the mysteries about themselves, and its completion enabled the human beings to have a full understanding of themselves at a molecular level. Therefore, the completion of the Human Genome Project is of epoch-making significance, but it also brought along with it some relevant problems and issues as listed below.



- (1) The security of personal genetic data storage may lead to possible genetic discrimination, misappropriation or abuse of genetic data.
- (2) Due to the diversity of the human genome, a single, standardized human genome could not represent the entire human genome. A separate study was needed for the genome of different races.
- (3) Genetic data was held in the hands of a few government agencies, large research institutions and large sequencing companies with special rights, and the genetic data was not safely and rationally utilized.



## The Current Status of Gene Sequencing Industry

In 2001, with the completion of the Human Genome Project, human beings entered the era of functional genomics, and gene sequencing technology also gained rapid development.

In 2001, according to NIH data statistic, the sequencing of the whole genome would cost as much as US\$100 million. In 2011, the cost of the sequencing of the whole genome was reduced to US\$10,000 because of the successful introduction of second-generation sequencing technology. In 2014, as Illumina HiSeq X Ten hit the market successfully, the cost of the sequencing of the whole genome was greatly reduced to US\$1,000. In the J.P. Morgan Healthcare Conference held in January 2017, Illumina NovaSeq 6000 was announced to enter the market, and it is deemed as a valuable asset to the gene sequencing market. The cost of the sequencing of the whole genome by NovaSeq is lower than that by HiSeq X Ten, and its throughput is two times larger than that of HiSeq X Ten. It took Illumina only three years to update the HiSeq X Ten to NovaSeq. With the decreasing cost of gene sequencing, gene sequencing will usher in a wide range of development prospects, and it will greatly promote the understanding of the occurrence and development of human diseases.



## The Current Status of Gene Sequencing Industry

In the foreseeable future, genomics related industries will achieve breakthroughs in the following four areas.

(1) Gene technology will be widely used in such research fields as complex diseases, agricultural genomics, microbiology and metagenomics, and bring huge changes to human health, agriculture, and environmental protection.

(2) The application of gene technology to reproductive health will significantly reduce birth defects and improve human health.

(3) Cancer genome research will reveal the pathogenesis of tumors, and tumor genome sequencing technology will become the basis for individual treatment of tumors.

(4) The combination of genome technology and the latest scientific research results of traditional clinical medicine has resulted in the formation of precision medical care that has revolutionized disease diagnosis, treatment, and clinical decision making.



## Opportunities and Challenges in the Gene Sequencing Industry

Gene sequencing is a new type of gene detection technology that can analyze and determine the whole gene sequence from blood or saliva, and predict the likelihood of a variety of diseases, and the characteristics and reasonableness of individual behavior. Gene sequencing technology can locate the disease-causing genes of individuals and prevent and treat them in advance. Gene sequencing technology is the next technology to change the world. However, there are still many problems and challenges in the sequencing industry.

(1) Currently, there is no safe and efficient platform for sharing genetic data. Large amounts of genetic data are not well used; each gene service platform is operated independently; the information of individual genetic data is not complete, and a customer's genetic data is just like as an isolated information island. These problems have caused the platform to provide limited services for gene data.

(2) Without industry standards, each genetic detection institution determines the corresponding detection site according to its own database, and the results that different genetic detection institutions conclude are different. The lack of industry standards for platform data is one of the main factors that hinder the rapid development of the gene detection industry.





## Opportunities and Challenges in the Gene Sequencing Industry

(3) The biggest risk of genetic data platforms is the risk of information leakage. DNA is the most important and private information of a person, and many personal characteristics can be read from the DNA information, such as personality, physical appearance, hobbies, potential, disease risk, and other aspects. Once the personal DNA information is leaked and improperly used, the consequences will be disastrous.

On the other hand, if we can solve the current problems to push the gene sequencing industry to develop in a healthier direction, we can definitely create more opportunities and benefits for human society. With such techniques as cryptography, distribution, smart contract, consensus protocol, and point-to-point network transmission, blockchain technology can prevent the data information from being illegally used, tampered with and deleted by centralized platforms, and provide safe and complete storage for gene mapping data information and a technical foundation for industrialized gene sequencing.





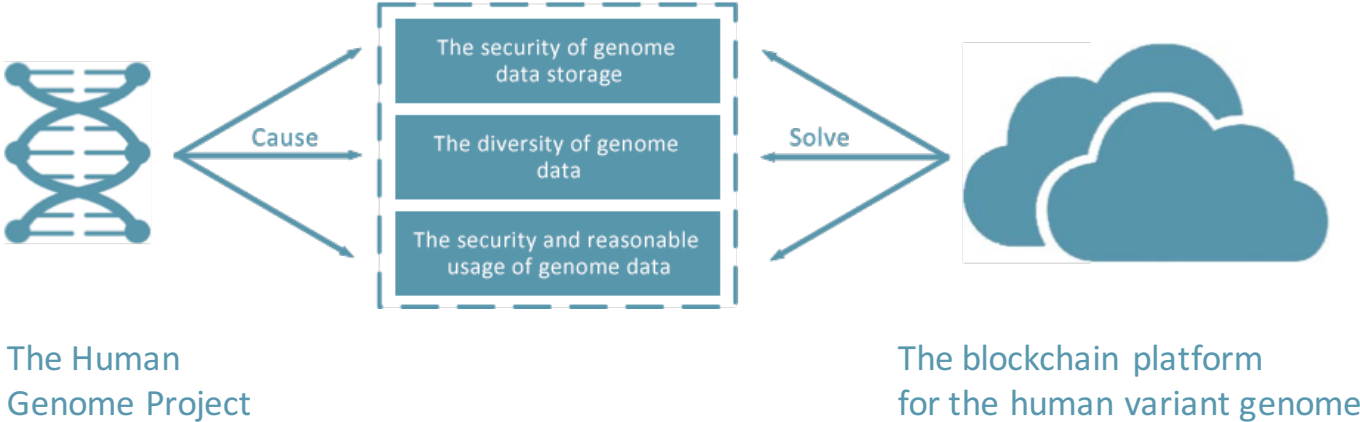
## The Goal of X Genomics

The goal of X Genomics is to build the world's largest genetic data ecological chain and a global genome data hub.. By enabling decentralized genome data storage, X Genomics will enable human genome data to be publicly accessible and ready for sharing while protecting the security and privacy of the data owner. Our mission is to create a global human genome data hub, mine the huge genetic data base and maximize the value of genetic data.

Blockchain is a new application mode of distributed data storage, point-to-point transmission, consensus mechanism, encryption algorithm and other computer technologies. The goal of X Genomics is to establish a global-level service platform for sharing big human genetic data through using blockchain. The blockchain infrastructure will turn the isolated human genome data islands into a unified one, and will also ensure the privacy and reliability of data sources, along with the security, legitimacy, and valuation of data retrieval. Through the integrated solution of the “blockchain + genome data analysis & collaboration system” , we will be able to mine variant genomic data so as to provide richer, more reliable, and easily accessible raw data for areas such as gene research, precision medical care, preventive health care, new medicine research & development, and human genetics, while protecting the privacy and rights of data owners.



## The Goal of X Genomics



The X Genomics blockchain is designed to provide genetic research industry partners with enterprise-level blockchain infrastructure, industry solutions, and secure, reliable, and flexible blockchain services. Through efficient and secure blockchain services, under the premise of secure and reliable transaction interconnection through visualized data management tools, the comprehensive cost of the gene technology industry can be effectively reduced, operational efficiency can be improved, and the application of traditional gene technologies can be solved.

# The Goal and Scheme



## Human Variant Genome Project

The Human Variant Genome Chain (hereinafter referred to as HVGC) is an ecological service chain focusing on the human genome data, which is designed according to the characteristics of gene sequencing data and the running status of the existing human genome database. In designing the infrastructure service platform for X Genomic, including the architectures of data layer, protocol layer, service layer, application layer, full consideration will be given to the security, stability, privacy and legal adaptability of genome data in pursuit of a fairer profit distribution pattern and a more incentive business model.

Thanks to blockchain technology, the genetic data on HVGC cannot be illegally tampered with and will be securely stored. Thus, users can upload their genetic data, medical examination reports, medical data and wearable device data to HVGC for automatic analysis. As such, users' health condition and future health predictions can be obtained. With this information, we will be able to provide users with more accurate and efficient personalized health care services.

On the HVGC, all information will be fully documented and effectively utilized. Individuals or institutions, without mutual trust, will be required to establish decentralized trust and privacy protection mechanisms without the coordination and supervision of a relevant authoritative center.



## Human Variant Genome Project

This will greatly help solve the difficult problems existing in the genetic sequencing industry. In promoting the generation of gene sequencing big data, the security of blockchain technology will make sequencing more industrialized, standardized, and applicable, thus achieving the implementation of sequencing on a global scale and promoting the massive growth of genetic data.

HVGC will solve the following problems in the genome data service industry.

(1)Blockchain is decentralized, open and transparent, and can prevent the information from being tampered with or counterfeited, so it can ensure the security and privacy of genetic data and guarantee the value of genetic data.

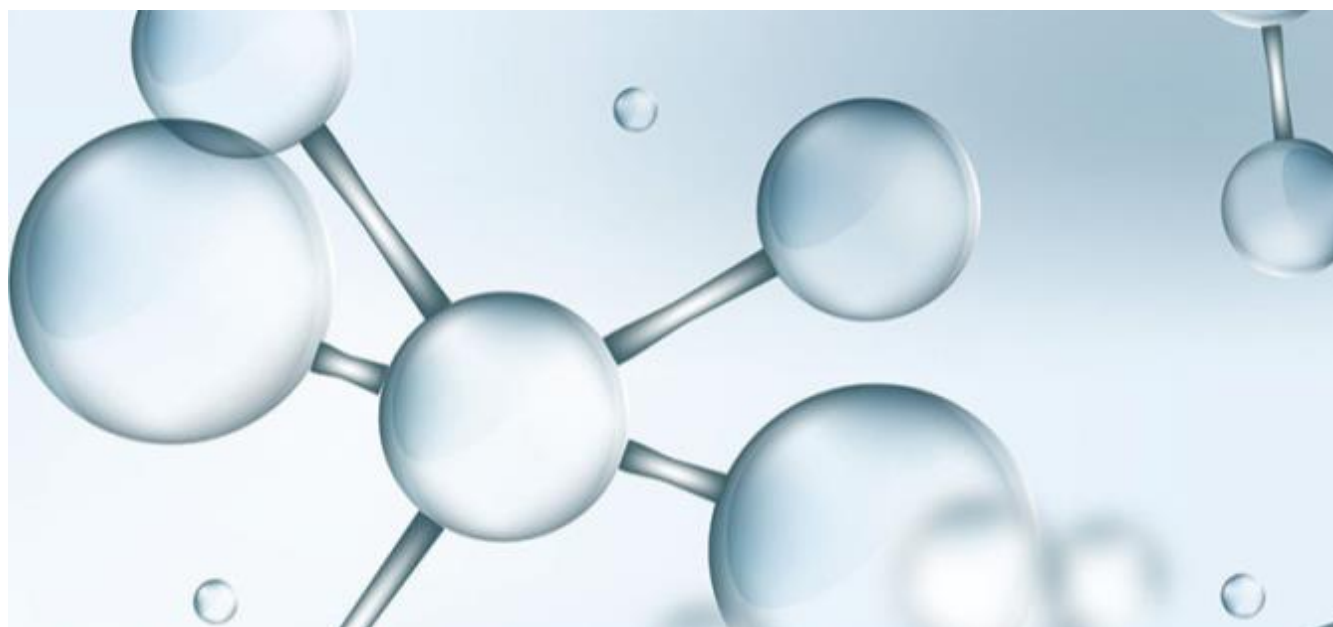
(2) Relying on the decentralized, anonymous, and transparent characteristics of blockchain, combined with the automatic interactive execution of smart contracts and other technologies, we will optimize genetic services and establish a unified, standardized system for genetic data analysis and collaboration.

(3) After the HVGC service platform is authorized, it will help users to access personal medical data, medical information and wearable device real-time data information, and combined with their personal genetic data analysis, we will be able to provide customers with more accurate and comprehensive personalized health management.



## Secure and Reliable Genetic Data Collaboration System

It is planned to build a genetic data collaboration service platform incorporating an extensible cross-chain service system based on individual and institutional nodes. The platform product service layer abstracts all typical kinds of gene blockchain applications, and provides the basic functions and implementation framework of typical applications. To achieve this framework, the business nodes can superimpose their own unique features based on these basic functions and then the blockchain of the business logic can be easily completed. Our plan is to help users quickly relocate existing genetic data services to the blockchain, meet more open and interconnected big genetic data requirements, and use the characteristics of blockchains, such as its tamper-resistance, trustworthiness, and traceability to solve the difficult problems existing in the current industry.



# The Goal and Scheme



## Open and Transparent Sharing Service Platform

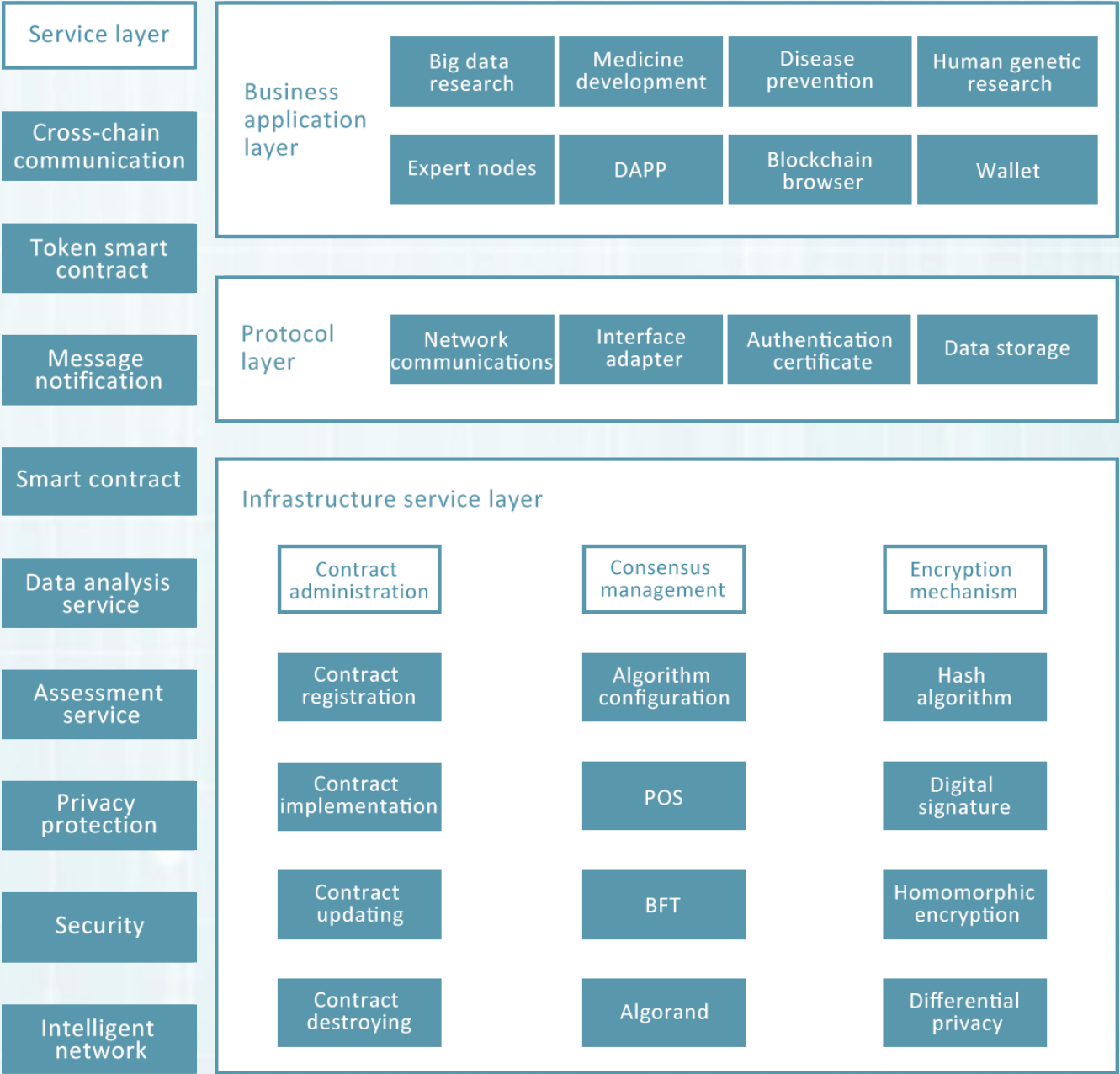


We will independently develop and construct a set of open service standard protocol interfaces, develop internal service functions, and share them with industry peers to break the information silos in the field of traditional genome sequencing, to develop traditional distributed databases and to realize the interconnection between different gene chains. Our ultimate goal is to jointly promote the development of a trusted Internet and create a win-win ecosystem for the genomic blockchain network.

The X Genomics blockchain sharing service platform will make more data accessible. It will enhance the security of data with its trustworthiness, security, and tamper-resistance and will truly realize the globalization of human genome data open services.



## Overall Architecture







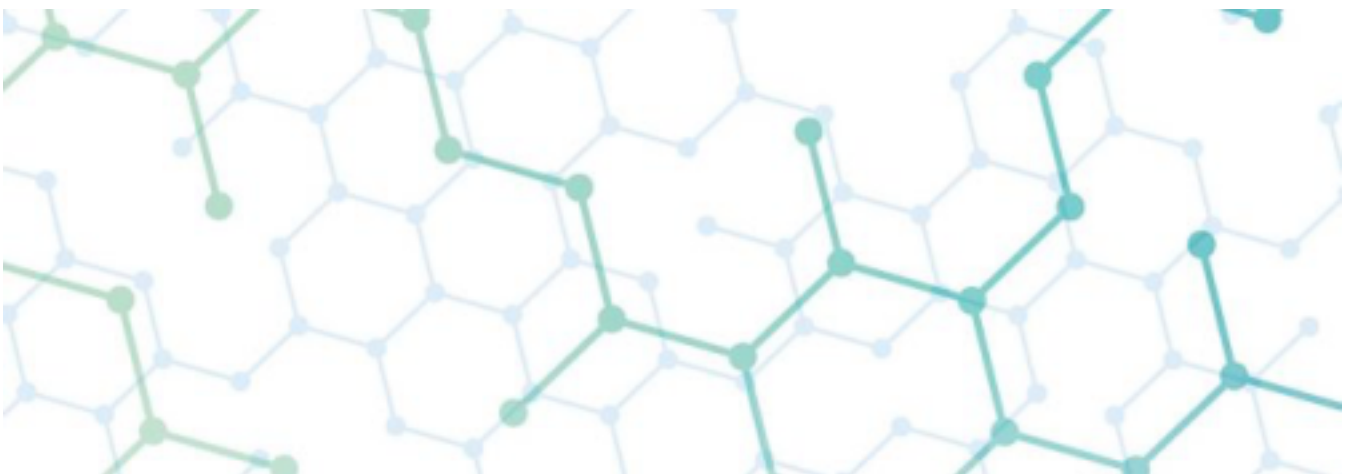
The overall architecture is positioned to be a leading human genome blockchain infrastructure platform. The infrastructure service layer is the core service layer of the platform. Based on the infrastructure service layer, a highly applicable and extensible blockchain service system will be built, including protocol layer, service layer and application layer. The protocol and service layers provide technical extension and support for the final application platform products, in which the infrastructure service functions of the related fields are integrated to help build upper blockchain application scenarios. The application layer provides the end users with reliable, safe and fast blockchain applications. X Genomics will work together with industry partners and its technical service providers to explore the blockchain development direction in the gene industry and jointly promote the implementation of gene blockchain scenarios.





## Consensus Mechanism

HVGC is expected to adopt BFT and DPoS combined algorithms in the consensus mechanism. The attention of system token holders in the DPoS algorithm and the importance of data nodes in the genomic data application scenario is well matched, while simultaneously, DPoS adapts well to the scenarios of the centralized trading and storage for genome data. In the DPoS algorithm, Witness(Witness mechanism) is used to solve the problem of centralization, while retaining some key advantages of centralization system. From the system level, DPoS can drastically shorten the process of a large number of possible blocks being validated by untrusted nodes in the process of transaction, so it will shorten the transaction time, and greatly improve the accommodation capability of transaction data. The Byzantine Fault Tolerance Mechanism (BFT) is a kind of consensus mechanism that adopts the principle that only those with granted rights have rights to vote and the minority shall





## Consensus Mechanism

be subject the majority to elect leaders and keep accounts. This consensus mechanism allows Byzantine Fault Tolerance (BFT), while also allowing strong supervisory nodes to participate, has the ability to grade authority, and has better performance and lower energy consumption. What's more, the leader will be jointly elected by the entire network nodes in each round of keeping accounts. It allows 33% of integrity nodes to collude to misuse data and its fault tolerance rate was 33%. This process is especially suitable for authorized genome research institutions to get involved in the application. Its improved algorithm is the most commonly used league chain consensus algorithm at present with modifications as listed below:

- (1) modified the topology requirement of the underlying network, and used P2P network.
- (2) dynamically adjusted the number of nodes.
- (3) reduced the number of messages used by the protocol. These two consensual mechanisms will restrict each other and the difficulty in adjusting them to work with each other will increase as the number of blocks of the same type increases. Dual mechanism may also make it more difficult for attackers to attack the system, thus ensuring the security of the system.



## The Constitution of Witnesses

In the early stage, the integrity nodes (witness) of HVGC will be constituted of authorized genetic detection institutions and publicly recognized professional medical institutions. Along with the development of HVGC, the community will be fully subject to the autonomy of the community.

The selection of genetic detection institutions and professional medical institutions with public trust as early integrity nodes is based mainly on the following considerations.

Generic detection institutions and medical institutions with public trust are eligible for long-term online access. Professional genetic detection institutions and medical institutions with public trust can fulfill the





## The Constitution of Witnesses

regulating role with their professionalism and public trust. Due to the particularity of the real identity of integrity nodes and the constitution of consensus mechanisms, the possibility of several integrity nodes jointly misusing data will be greatly reduced.

With the continuous development of the HVGC and the increase of data, HVGC will retain the right to be an integrity node for government genetic research institutions and official professional medical organizations in order to meet the regulatory needs of various countries, so that genomic data sharing can be more secure while developing more openness.



## Data Security

### The Security of Data Network

For the X Genomics blockchain, its genome ledger data will be fully or partly accessible. It emphasizes that the ledger data shall be stored in several copies without the risk of data loss. The blockchain currently adopts fully-distributed storage, with many full nodes in the network that synchronize all the ledger data. As such, there will be enough copies of ledger data in the network to meet the requirement of high availability and ensure the low risk of data loss. Therefore, it is recommended that when deploying a blockchain network, all nodes shall be scattered as far apart as possible, in different countries, different basic service providers, different interests and beneficiaries.

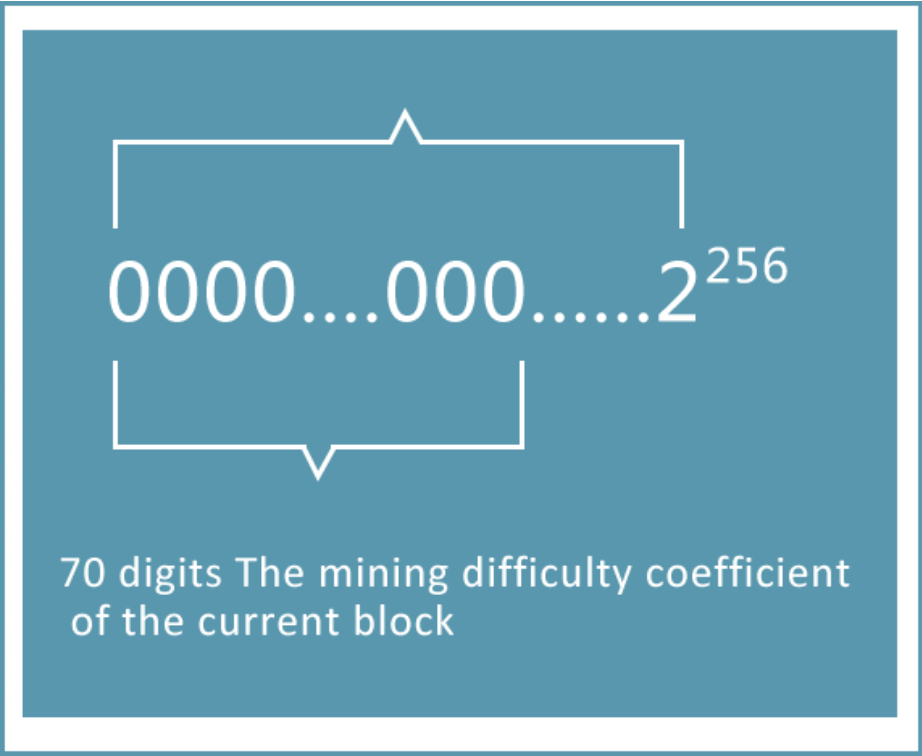
### Multiple Encryption

The sensitive information on the X Genomics chain, such as privacy data, usage data, storage location, is designed with multiple encryption, and encryption keys will be given to relevant participants. Even if a single node is compromised, the difficulty of its data parsing can make the attackers end up with no profit or their losses outweigh their gains, thus greatly reducing their willingness to attack.



## Data Security

### Tamper-resistant Data



Distributed ledger technology is a multi-point, data-consistent distributed accounting technology. Due to the data storage mechanism of blockchain, tampering with the data requires a huge amount of calculation cost, and it is very difficult for individuals or organizations to master this kind of calculation. Therefore, the data will not be illegally tampered with.

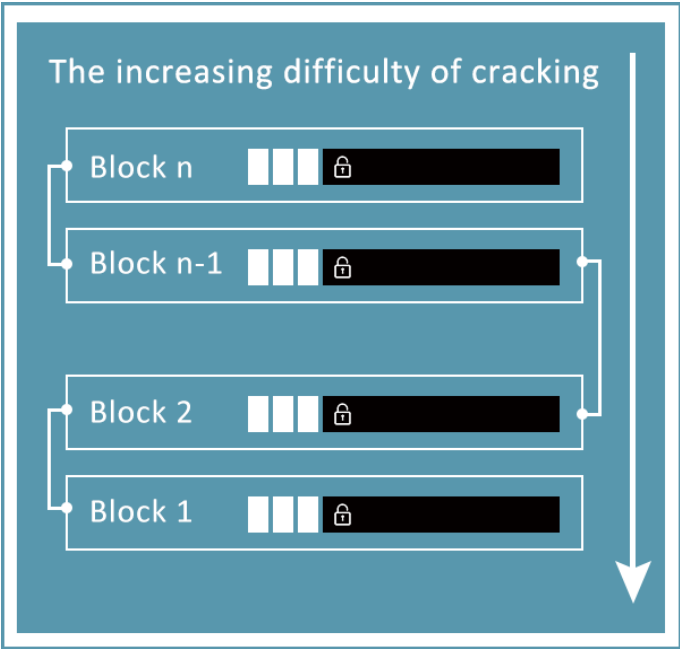




## Data Security

### Tamper-resistant Data

Besides, cryptography will be well applied in the blockchain. The blockchain adopts a large number of cryptography techniques, such as asymmetric algorithms, elliptic curves, RSA, etc. There are strong mathematical models behind the asymmetric algorithm, and it is difficult to break through the

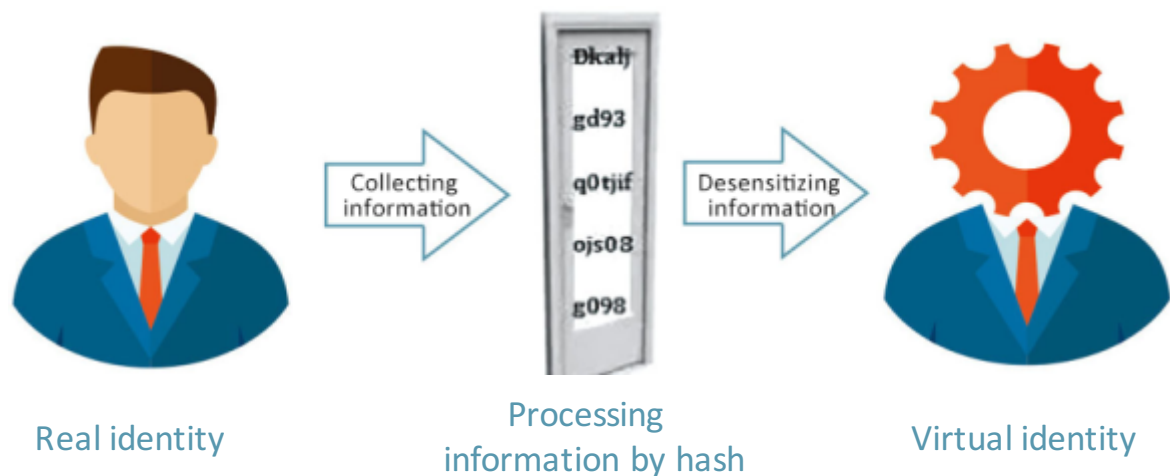


underlying mathematical problems with the existing computer technology. In addition, the blockchain adopts the principle of superposition with one layer overlaying another one. Therefore, if someone wants to modify a block, he/she shall modify all layers one by one from the beginning. It can be clearly seen that the calculation cost for one block is large, which in turn greatly reduces the possibility of data being tampered with.



## Privacy Protection

### Data Desensitization



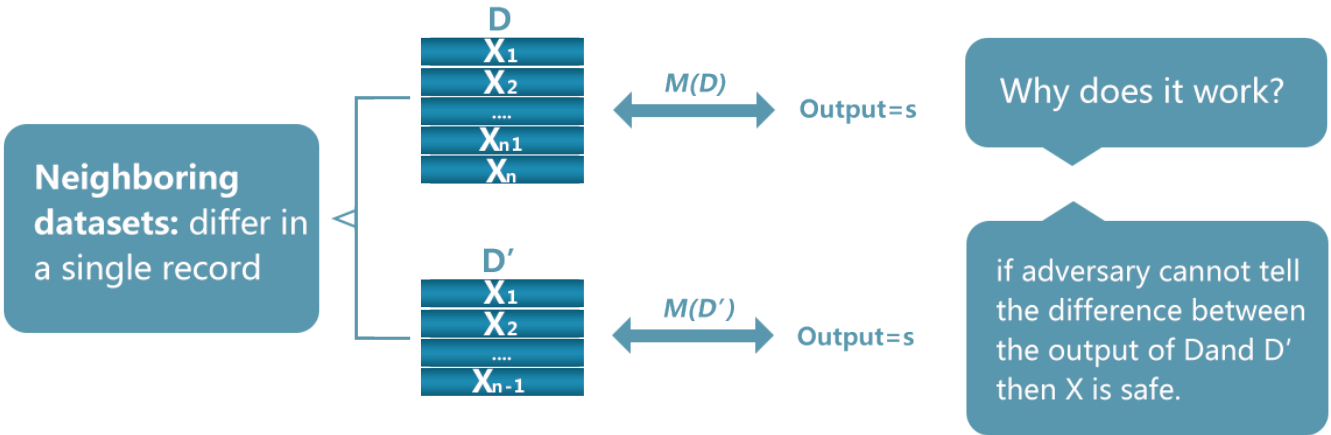
The main difficulties and challenges of data opening are how to open data while protecting personal privacy. Blockchain-based technology can guarantee the privacy of data and make data opening possible while protecting its privacy protection. The data desensitization technology based on blockchain can guarantee the validity of data sharing when the data is desensitized. Blockchain data desensitization mainly uses Hash desensitization and differential privacy to protect the basic privacy of individuals from being leaked. Human genome data has its purposes in one way or another, so even with desensitization treatment, the data may still be abused. For instance, some details such as non-sensitive information, location, gender and age can be used to do marketing by sending promotion activities or other marketing information to a specific group. In HVGC, besides using desensitization technology to ensure privacy, to avoid any possible bad behavior by



## Privacy Protection

purchasers, all HVGC’s integrity nodes will be set to have the right to check the data transfer and usage status in a fixed period. Once someone’s data usage behavior is found suspicious, the internal adjustment mechanism will automatically reduce his/ her access permissions, or even permanently deprive his/her right to get access to the data in the X Genomics system.

## Data-leak Prevention



In the work of big data analysis, how to effectively protect personal privacy and prevent core data from being leaked has become the primary concern. With the spread of genetic data detection and analysis techniques, more and more people have come to realize that once the personal data is leaked, there will be serious consequences. HVGC can prevent the occurrence of such events by using various private keys, differential privacy, safe multi-azimuth calculation, multi-layer encryption technology and other relevant techniques. When the data is stolen by hackers, we can use digital multidirectional cognitive technology to have data accessible only to authorized people.



## Certification and Supervision

### Data Ownership and Supervision

It is required to identify big data ownership and distribution channels. As for high-value genomic data assets, we can use the blockchain registration method to obtain the source information of the traceable big data highly recognized by the entire network, including big data sources, usage rights, circulation channels, etc. It is highly efficient in protecting data assets.

The advantages of this approach mainly lie in the following two aspects. On one hand, it is conducive to the establishment of genomic data asset trading environment, thus safeguarding the legitimate rights and interests of data owners. On the other hand, the traceability path provided can effectively solve the attribution of data access, because multiple nodes involved in computing through the internet participate in the calculation and recording of data, and mutually verify the validity of their information. This can verify the validity of information and the information is also traceable. By connecting all information of different links, a clear chain is formed.

All information is effectively protected, thus ensuring the legitimacy and privacy of big genetic data sources, and the big genetic data also will be more active and orderly.

## Cross-chain Transactions



We put forward the brand-new concept of superposed chains. Among the various problems that the blockchain is facing, the network isolation hampers the collaborative operation between different block chains, and greatly limits the development space of block chains. X Genomics will keep the cross-chain service interfaces in the architecture design. We will not only solve the problem of information silos in the traditional database, but also will solve the problem of information sharing in the cross-chain data in this era of blockchain data. We will offer a more open and transparent genome data sharing service platform through cross-chain protocols, which will prove to be a forward-looking design. In the future, the bottom layer of block chains will no longer be a parallel, isolated data chain, but an interconnected block network.



## Construction of a Secure Genetic Storage Database

Decentralized gene storage data chain can pack individual genetic data, run in a block manner, and form distributed ledger storage. It therefore will solve such problems as the security and privacy of genetic data sources, and ensure that users' genome data cannot be tampered with and will be in the whole control of users. In this way, we will build a decentralized, trustworthy, tamper-resistant and traceable HVGC data system.

Individuals can store their genomic data in encrypted and undecipherable HVGC. Owners can authorize their doctors to use their time-limit keys. Scientists can access metadata such as age, race and gender, but cannot search for any personal information about donors. Research institutions can buy permits to store data without worrying about ethical claims. Researchers can also apply to donors for access to data, and donors can decide which data to open. Blockchain technology will revolutionize genomic science and provide more protection for data.





## Study of Gene and Rare Diseases



The genetic ecological blockchain platform will invite other genetic research organizations to join the community. With the increase of human genetic data across national borders and ethnic groups, we will be able to discover more answers to key questions about human longevity, genetic diseases, and aging.

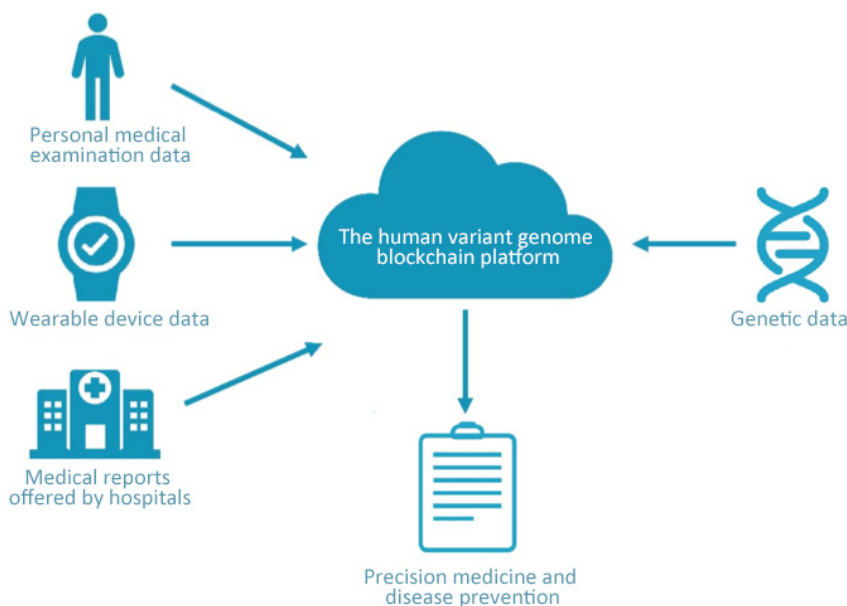
The main reason for the low cure rate of rare diseases is that the incidence is low and the available data is less, so it is impossible to conduct sufficient researches to obtain effective cure methods. The genetic ecological blockchain platform will provide more opportunities or data for the study of rare diseases. On one hand, the increase of genetic data can increase the sample size of rare diseases and accelerate the research process. On the other hand, the increase of relevant genetic data can provide support for the pathogeny analysis of rare diseases, and provide simulated data for the study of medicine for rare diseases.





## Precision Medicine and Disease Prevention

Through blockchain technology, we can develop and offer block-oriented and decentralized gene data services. We will make the best use of blockchain’s characteristics like decentralization, anonymity, openness, transparency and irreversibility, and smart contracts’ characteristics like automatic interaction and execution to optimize genetic services and establish a unified, standardized service platform for genetic data analysis and sharing. For example, users can upload their personal medical examination report data and wearable device detection data to the platform in real-time. Then, combined with their personal genetic data, the platform can quickly and efficiently analyze the users’ health conditions and provide a comprehensive follow up with them. In this way, we can have a better understanding of users’ health status and develop a latest health report for them, and provide users with more accurate, precise medical care and personalized health management schemes. Meanwhile, as an open platform, all individuals and institutions dedicated to the sharing and development of genetic data can join our community service platform, and work together with us to make it better and create more value for society.





## The Impact of HVGC on the Development of Society

### Gene-based Searching for Lost Relatives

By comparing the information in the database, HVGC can help users find their “lost” relatives and bring their family happiness back. It is especially true when natural disasters occur. HVGC can serve as a great help for users to find their relatives after natural disasters. In this sense, HVGC is conducive to the stability of the society. For example, HVGC can be used to search for abducted children and elderly people with dementia.

### Gene Identification Cards

Gene consists of a series of fragments that contain all of the genetic information of a person. People carry it with them when they were born and it will never change. Gene identification cards use DNA fingerprinting technology, which has matured at home and abroad and selects several fixed genetic loci for identification. The number of gene identification cards is composed of several figures that can represent the characteristics of these genetic loci. The combination of these selected genetic loci is unique, so they can be used for personal identity authentication.



## The Impact of HVGC on the Development of Society

### Gene-based Education Management for Children

HVGC can help find out the strengths and weaknesses of children to help them grow healthily. It can effectively help develop personalized health management strategies for children based on their innate traits, so that children can receive a high-quality personalized and tailored training and education, which fits into their own characteristics.



### Gene-based Pairing

Now a lot of couples will do genetic screening before having a baby. The human variant genome blockchain platform can help users select the most suitable genes from the wealth of gene data, and then users can contact the owners of genes that best fit theirs. This gene-based pairing will change the current form of mating and provide strong support for human genetic progress.



## The Impact of HVGC on the Development of Society



### Gene-based Social Networks

Modern researches suggest that gene determines people's social appetite to a certain extent. In the face of the modern high-paced social life, how to make a friend whose temperament, personality and interest is similar to ours is a question worth thinking about. The human variant genome blockchain social network platform, which is based on genetic data analysis, can help solve this problem in the future. It will greatly reduce the users' cost of making friends, help them make friends more quickly and create their own social networks. As such, users will benefit a lot from their life and work.



## The Issuance of GSX Tokens

The X Genomics blockchain has a built-in native token (X Genomics Chain Token, symbol: GSX). The current GSX tokens are issued by Human Genomics Research Foundation LTD which was founded in Singapore. It was designed in accordance with ERC-20 as stated in the standard protocol of Ethereum, with a maximum issuance of 1,000,000,000 pieces.

## The Circulation and Distribution of GSX Tokens

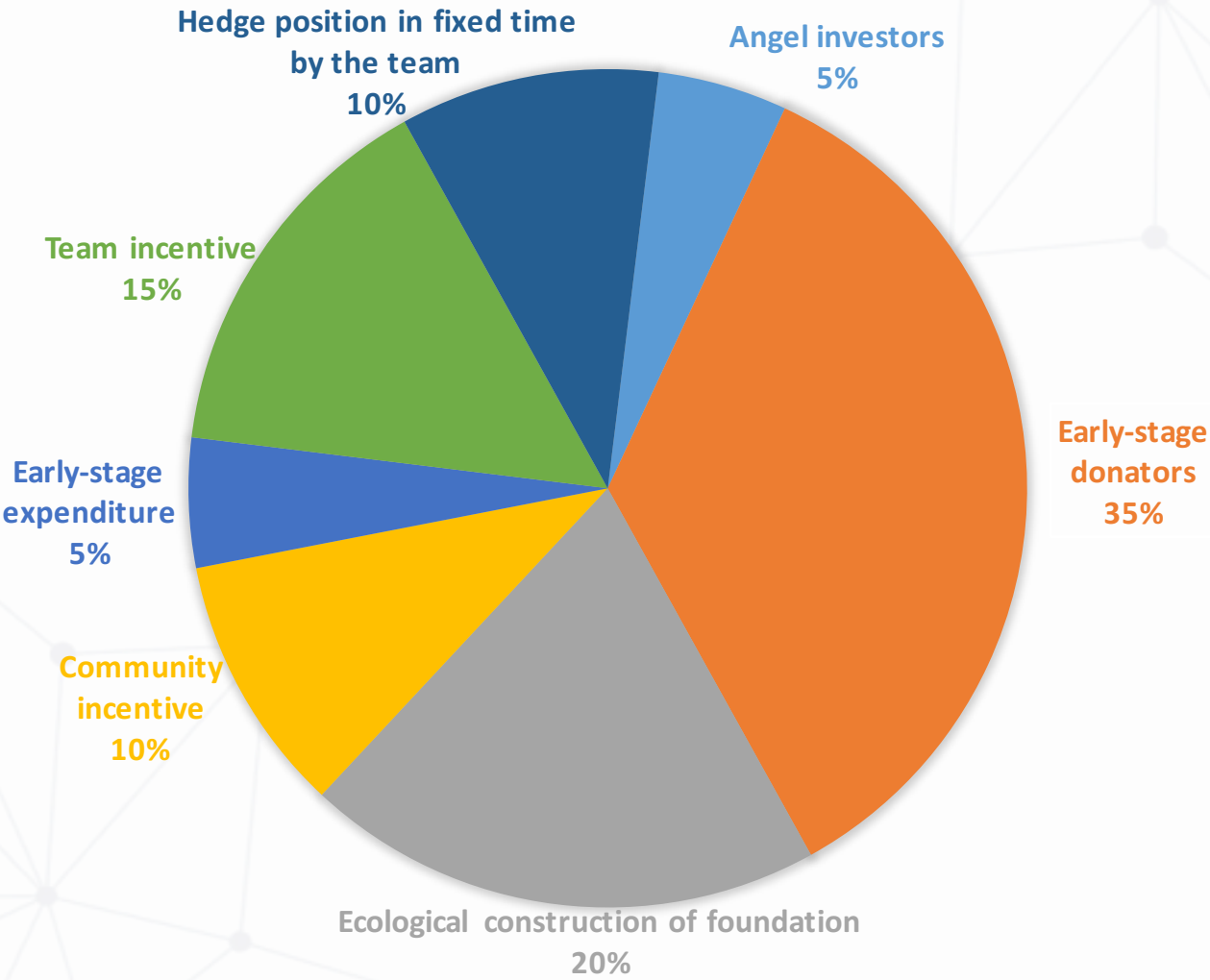
GSX is the token of the X Genomics blockchain, an equity certificate on the X Genomics ecological chain, and an economic means of X Genomics ecosystem. GSX's main role is to provide liquidity for digital asset transactions on applications, which are built based on X Genomics, and to serve as a payment mechanism for transactions on X Genomics ecosystem.

If users upload their genome data to the X Genomics blockchain and their genome data is used, they will obtain tokens. If research institutions make researches based on big genetic data and their researches yield good results, they also will obtain tokens. Profession medical institutions or individuals use X Genomics' data or research results, or create their own applications based on the X Genomic blockchain, they need to make payment by GSX tokens.



## The Distribution Scheme of GSX Tokens

The GSX tokens are distributed as follows.





## Human Genomic Research Foundation LTD



The Human Genomic Research Foundation LTD (hereinafter referred to as “Foundation”) is a non-profit organization based in Singapore that focuses on genetic research.

The Foundation, as the main administrator of the X Genomics blockchain project, will standardize the development of X Genomics technologies and applications, protect the rights and interests of GSX holders, propagandize and popularize the X Genomics brand, and promote the security and harmonious development of gene ecological chain community. To make it, the Foundation will develop a sound governance structure to help manage the daily and prerogative matters of the open source community, fairly exercise their powers and rights authorized by the community, and commercialize the community.

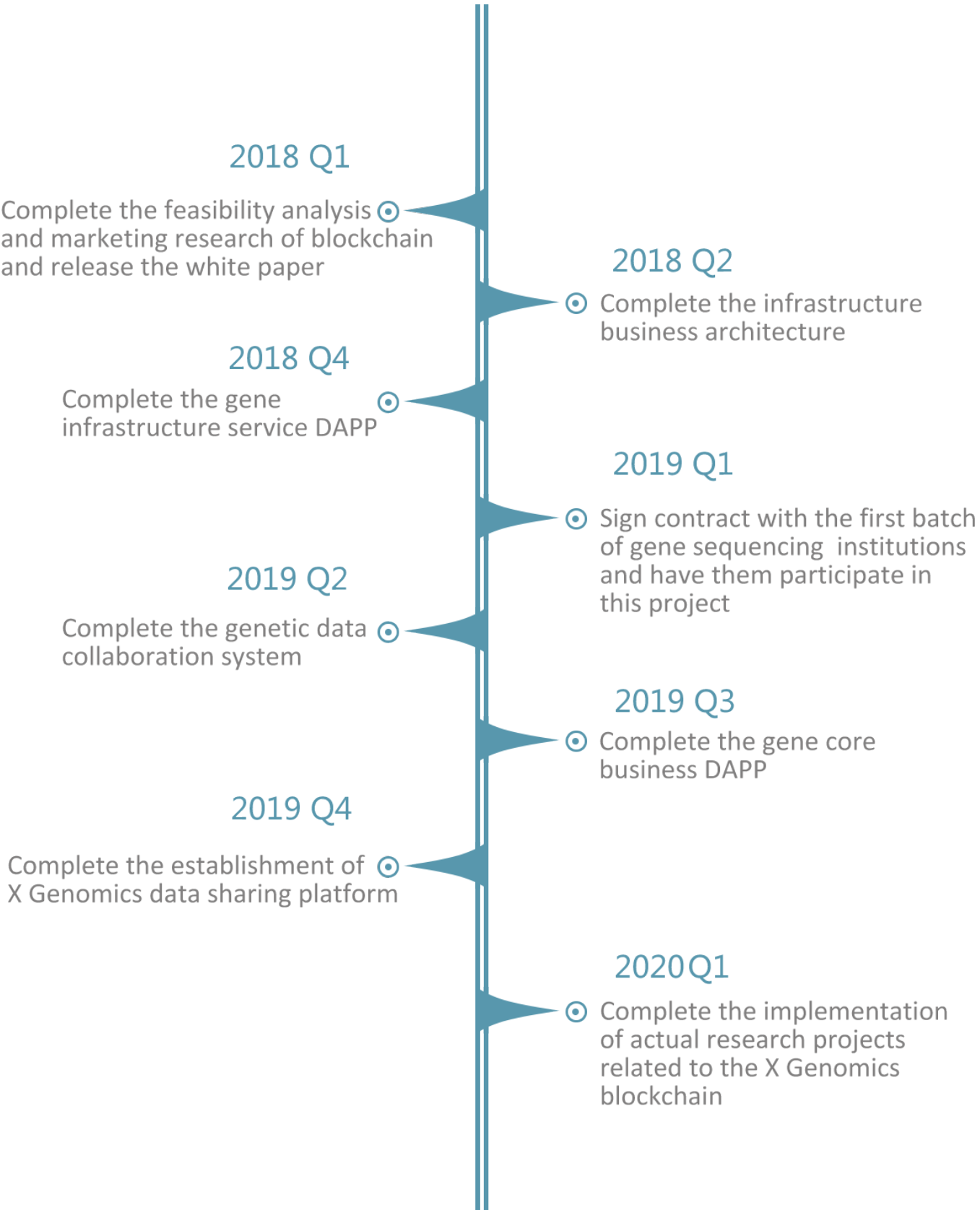




## Human Genomic Research Foundation LTD

The design goal of the Foundation's governance structure is to ensure and maintain the sustainability, the effectiveness of management and the security of fund raising of the open source community. The Foundation will disclose the scope of activities related to the development, promotion and maintenance of X Genomics system. In the event of an incident affecting the reputation of the Foundation, the Foundation shall conduct a public relations response after an internal audit evaluation.

The purpose of the Foundation is to provide a professional international trading platform and financial products for digital asset fans and investors all over the world without violating the relevant laws and regulations of Singapore. It is forbidden to use GSX digital assets to engage in money laundering, smuggling, commercial bribery and other illegal transactions. If such incidents are found, relevant accounts shall be restricted and relevant parties shall be reported to relevant authorities.





## Appendix 1 Cautions and Risks

### Cautions

1. Chinese citizens or citizens of other restrictive countries shall be strictly prohibited from participating in the donation activities for regulatory reasons.
2. Only authorized institutional investors may participate in the donation activities, and we may conduct appropriate screening on institutional investors.
3. When the donation amount reaches the target quota, we shall stop the relevant work immediately and unconditionally.
4. Large quantities of digital assets will be used mainly by investors. Transactions will proceed non-stop throughout the day, and there shall be no limit to the range of increase or decrease, so the transaction has a high rate of risk, and the price will be greatly and easily affected by bankers and governmental policies.
5. Digital asset transactions may be suspended or prohibited at any time in the event of the enactment or modification of national laws, regulations and normative documents of any countries.



## Appendix 1 Cautions and Risks

### Cautions

6. Anyone participating in the donation activities shall be considered to have confirmed these cautions and the legal disclaimer as below, and shall bear the investment risk of the digital assets. Meanwhile, the Foundation as mentioned in this document reserves all rights.
7. This document is not intended for persons other than the intended recipients. Replication is strictly prohibited.





## Appendix 1 Cautions and Risks

### Risks

Please note that this project has the following risks.

#### 1. Compliance and operation risk

Compliance and operation risk is that X Genomics violates local laws and regulations in the process of raising funds or carrying out business, which causes the project to stop. The compliance and operational risk operation team is taking the following measures to avoid unnecessary compliance and operation risk:

- (1) The operation team and decision-making committee will adopt a distributed operation mode to exclude the single point risk.
- (2) Professional local lawyers from the regions where business is carried out will be hired to design such businesses as digital asset issuance, digital asset transactions, blockchain finance and blockchain applications in accordance with legal requirements.

#### 2. Market risk

Market risk is that X Genomics is not accepted by the market or is not used by enough users, or its business is stagnant and there is not enough profit to support it. The market risk operation team is taking the following measures to avoid unnecessary market risk.



## Appendix 1 Cautions and Risks

### Risks

- (1) The concept of X Genomics will be shared with industry peers and other relevant institutions or individuals invited to participate in this project and optimize it.
- (2) The experience of the founding team in their respective fields will be fully used to seek more cooperation resources.
- (3) An application scenario will be built timely based on HVGC, while institutions with relevant applications will be incubated to make profits.

### 3. Technical risk

Technical risk includes, but is not limited to, the emergence of major problems in the underlying technology, which results in the failure of X Genomics to achieve the expected function or the manipulation or loss of key data. The technical risk operation team is taking the following measures to avoid unnecessary technical risk.

- (1) Based on the mature, open source and secure blockchain technology, we will adopt architectures which have been recognized and verified by commercial customers.



## Appendix 1 Cautions and Risks

### Risks

(2) After the Foundation raises enough resources, we will attract more high-end talent from the industry to join our development team to lay a solid foundation, enrich our strength and borrow others' mature development and operation experience.

#### 4. Capital risk

Capital risk is the significant loss of project funds, such as the capital being stolen, the loss of capital, sharp depreciation of reserve funds, etc. The fund risk operation team is taking the following measures to avoid unnecessary capital risk.

(1) The reserve funds will adopt an integrated management mode of parity wallet (multi-sig wallets) + cold storage, which will be jointly administrated by a decision-making committee. With multi-sig wallets, only when there are three directors unable to perform their duties will the reserve funds be at risk.

(2) The operation team has rich experience in risk control, so it can effectively control the project's risks and protect users' interests.





## Appendix 2 Legal Disclaimer

This document is used only to convey information and does not constitute an agreement to buy and sell the X Genomics project’s GSX tokens. The above information or analysis does not constitute an investment decision. This document does not constitute any investment proposals, investment intention or investment instigation. This document does not constitute or shall not be understood as the act of providing any form of purchase or sale, or invitation to purchase or sell any form of securities, or any form of contract or commitment. Interested users shall have a full understanding of the risk of the gene chain, and once investors participate in the investment of this project, they shall be considered to have understood and accepted the risk of this project.

