Genome India project

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Why is in news? The Genome India project, aimed at creating a genetic map of the country

The government's Genome India initiative on February 27 announced the **successful sequencing of 10,000 whole genomes of healthy persons** from across the country, creating a genetic map of the population.

Researchers from 20 science institutes across the country helped in collecting the blood samples, sequencing the genome, developing a methodology, and storing the data.

With each sequence requiring 80 GB storage space, the huge dataset of 8 petabytes will be stored at the Indian Biological Data Centre in Faridabad. This dataset will be **made available to researchers as "digital public good**."

The data can be **utilised to develop new diagnostics, targeted therapies, identify new rare diseases, and cure existing ones.**

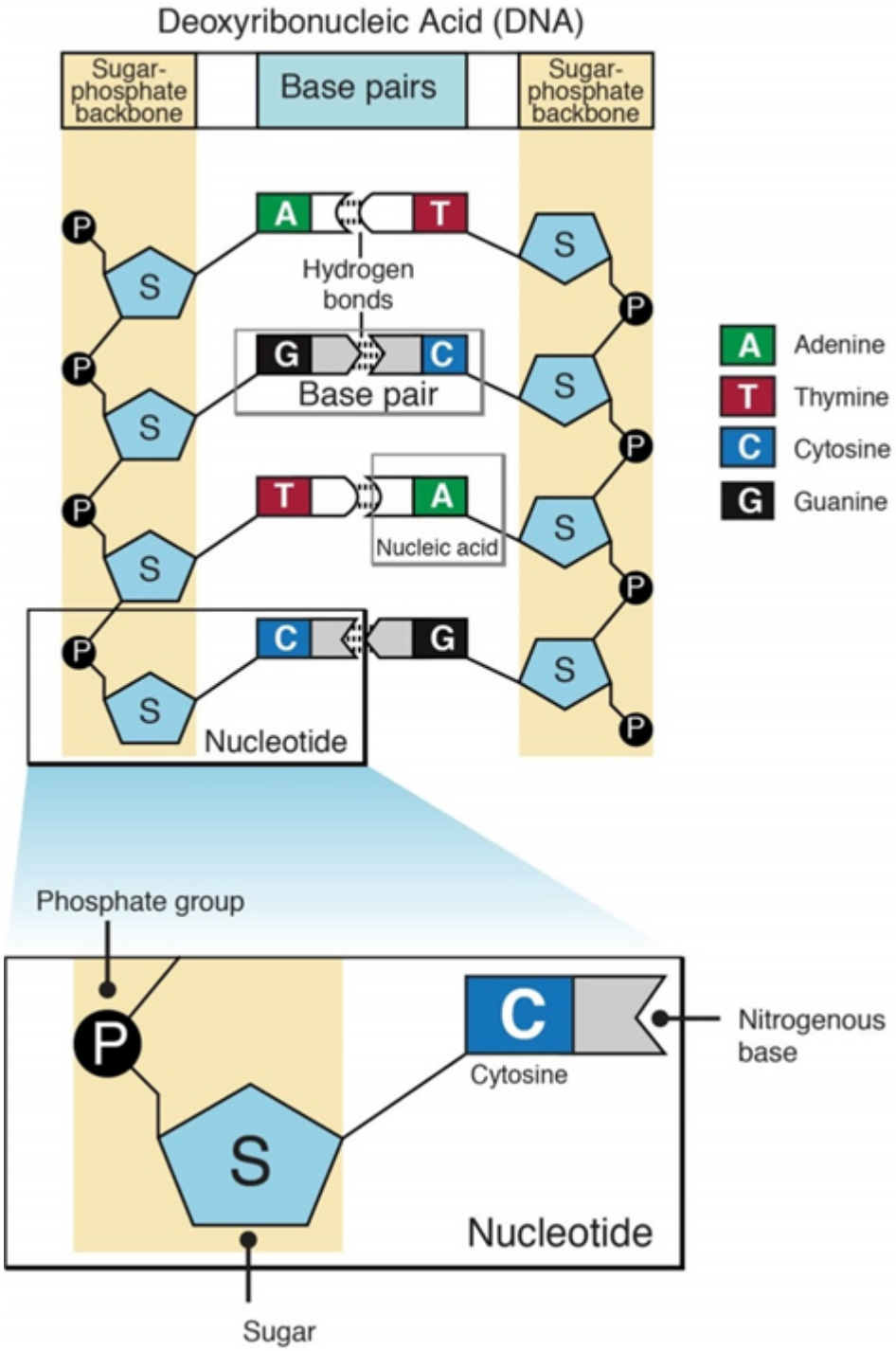
About the project:

The Genome India project was **approved by the government in 2020** with the aim of creating a **comprehensive catalogue of genetic variations** found in the Indian population.

GIP draws inspiration from the success of the international Human Genome Project, which decoded the entire human genome **between 1990 and 2003**.

A **map of genetic diversity** is essential for understanding the **history of our evolution, discovering the genetic basis for various diseases, and creating therapies of the future.**

This cannot be done using data available in existing international databases, as Indian genomes are likely to be different from that of other populations.



Researchers who analysed 5,750 of the genome sequences have already identified 135 million genetic variants found in India.

This map will also create a unique resource. This is because our population of 1.4 billion consists of more than 4,600 distinct groups.

With endogamy — marrying within the same community — common in India, the various groups have maintained their distinct genetic makeup. This can help compare and contrast the impact of genetic variations on physical health.

Union Science minister Dr Jitendra Singh described India as the "**largest genetic lab in the world**."

Objectives:

To **comprehend the genetic variations and disease-causing mutations** prevalent in the Indian population.

To facilitate the **development of personalized drugs and therapies** tailored to the genetic makeup of individuals.

Genome sequencing:

Genome sequencing is the process of determining the DNA sequence of an organism's genome.

A genome is a **complete set of DNA** that contains all of the genes of an organism.

Genome sequencing involves figuring out the order of bases in an organism's entire genome.

It is supported by **automated DNA sequencing methods and computer software** to assemble the massive sequence data.

How is it Sequenced?

The human genome is **essentially a biological instruction manual** that we inherit from our parents.

It is a tome written with just four letters, A, C, G and T — the four bases that come together to create everyone’s unique genetic makeup. There are **around 3 billion pairs of bases** in the complete human genome.

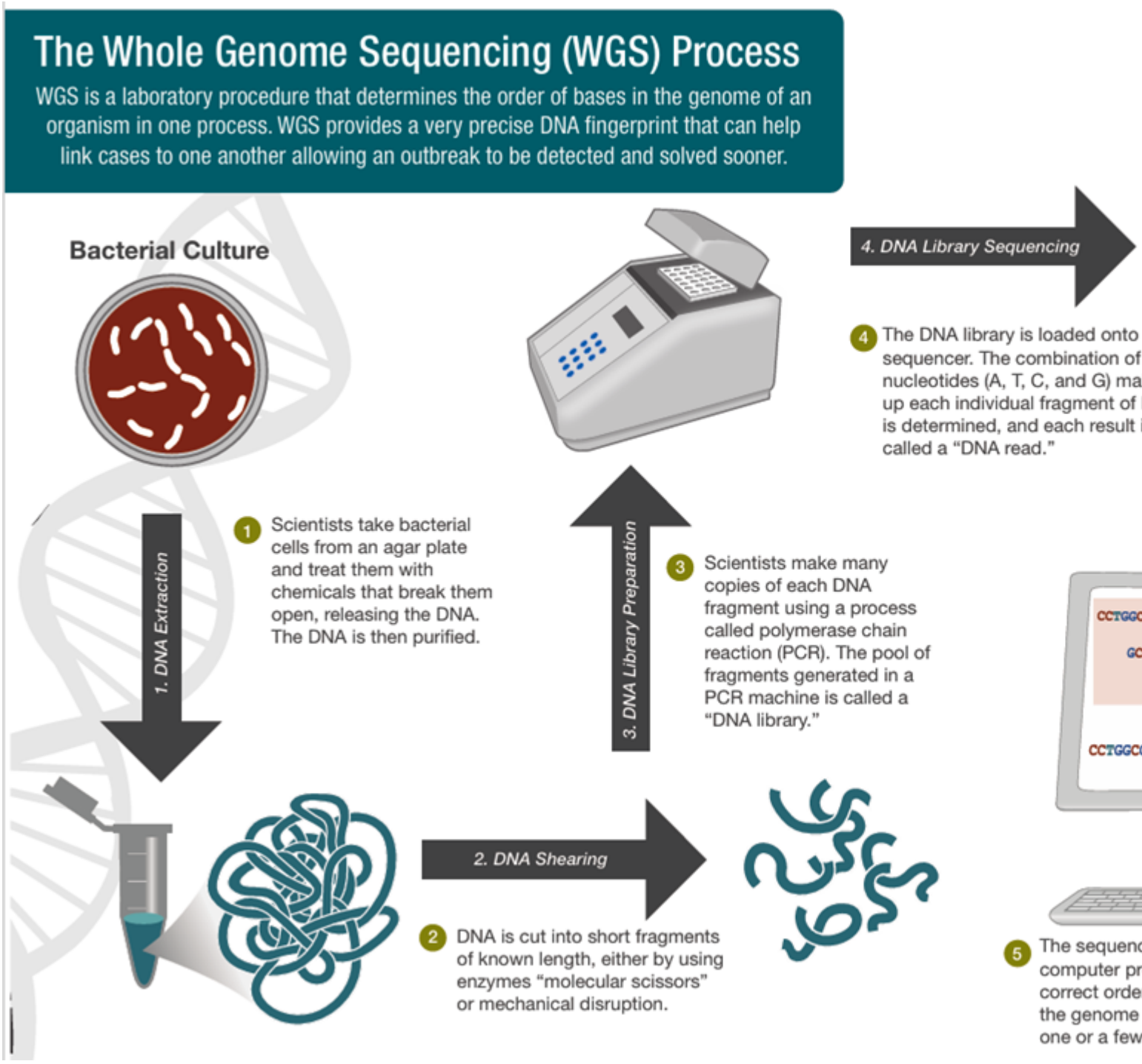
This contains all the information needed to create your physical form and maintain it throughout life.

From your height, colour of the eyes, the genetic diseases you get or those you are at a higher risk for, everything is determined by the genetic makeup.

To sequence the genome, researchers first extract the information from the blood.

With a complete sequence of 3 billion pairs being extremely hard to handle, scientists cut it up into small pieces and tag them — like you would when you disassemble furniture.

The A, C, G, T code of these smaller chunks are written down by a DNA sequencer and then the complete sequence is put together.



Applications:

Biotechnology: Genetic data can fuel advancements in biotechnology, enabling the development of novel treatments and technologies.

Agriculture: Understanding genetic variations can aid in crop improvement and agricultural practices suited to diverse Indian environments.

Healthcare: Personalized medicine and diagnostics based on genetic predispositions can revolutionize healthcare delivery, improving treatment efficacy and patient outcomes.

Uses of studying the genetic makeup of the country:

It can help **identify the genetic basis or genetic risk factors** for various diseases.

It can **help in targeted treatments**, especially for rare diseases that usually arise from genetic anomalies. For example the under-development mRNA vaccine to prevent relapse of pancreatic cancer, which is based on a genetic mutation that allowed a small group of pancreatic cancer patients beat the odds. The mutation allowed their immune system to identify the cancer cells and attack them.

It can also **help in identifying resistance-indicating variants** — for example, genes that might make certain medicines or anaesthetics ineffective in certain populations. An example from India is a set of a Vaishya community from South India, who lack the gene for properly processing common anaesthetics. For this group, use of such anaesthetics can result in death.

Earlier projects regarding genome mapping:

Genome India Project: It was spearheaded by Centre for Brain Research. It aims to build a grid of Indian reference genome to understand the type and nature of diseases and traits that comprise the diverse Indian population.

International HapMap Project: It is a partnership of scientists and funding agencies from Canada, China, Japan, Nigeria, the United Kingdom and the United States. The goal is to determine the common patterns of DNA sequence variation in the human genome and to make this information freely available in the public domain.

1000 Genomes Project: It began in 2008 and created a catalogue of common human genetic variation, using openly consented samples from people who declared themselves to be healthy.

The **International Genome Sample Resource** (IGSR) maintains and shares the human genetic variation resources built by the 1000 Genomes Project.

Future Implications:

Insight into Population Diversity: The project aims to provide deeper insights into India's genetic diversity, facilitating improved diagnostic methods and medical counselling.

Personalized Medicine: Identifying genetic predispositions to diseases and developing personalized drugs are envisioned outcomes, enhancing healthcare interventions.

Biobank Establishment: A biobank housing 20,000 blood samples, located at the Centre for Brain Research, IISc, supports genome sequencing efforts.

Data Archiving: Data archiving at the Indian Biological Data Centre (IBDC), set up by the DBT at the Regional Centre for Biotechnology (RCB), Faridabad, underscores the project's commitment to transparency and collaboration.