



**S&I Article**

# DNA

Nature's Instruction Manual



## What is DNA? Why is it important?

DNA stands for **deoxyribonucleic acid**. It is the **blueprint of life**, carrying instructions that make each living being unique. DNA is found in the nucleus of every cell and controls the function of the body.

DNA is used in many areas, from science to everyday life! Here are a few key places where DNA plays a role.

## Where Is DNA Found?

DNA is present:

Inside the **nucleus** of every cell. Packed tightly into structures called **chromosomes**. In humans, there are **46 chromosomes** (23 pairs).

## DNA in Simple Words: Nature's Instruction Manual

Think of DNA as a **long instruction book** written inside every living cell.

Each instruction tells the body how to grow, repair and function. These instructions are written using just **four chemical letters**:

- A (Adenine)
- T (Thymine)
- G (Guanine)
- C (Cytosine)

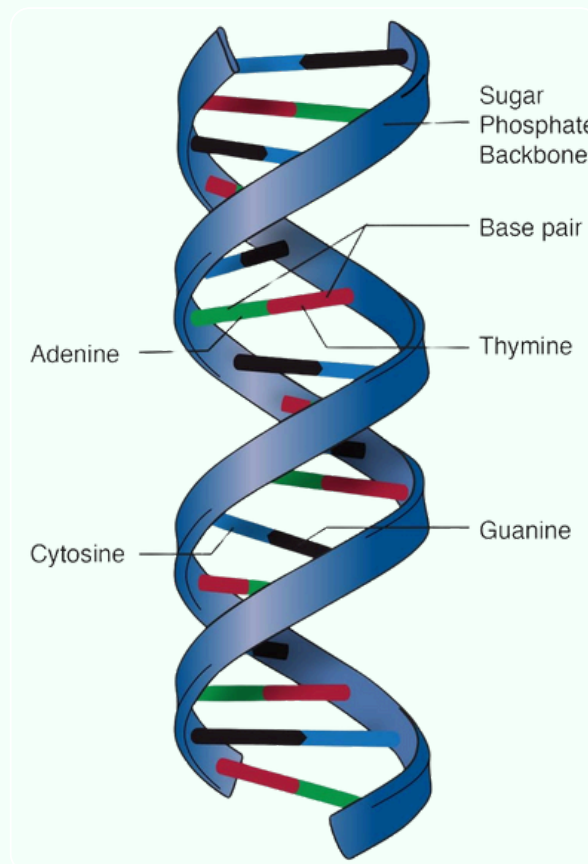
**Medicine & Health:** Used in genetic testing, diagnosing diseases, developing treatments, and researching hereditary conditions.

**Forensics:** Helps solve crimes by analysing genetic material left at crime scenes.

**Agriculture:** Used in genetic engineering to create disease-resistant crops and improve food quality.

**Ancestry & Genealogy:** Helps trace family history and find genetic connections between people.

**Biotechnology:** Used in producing medicines, like insulin and in synthetic biology to engineer organisms.



The Role of DNA in Science, Agriculture, Medicine, etc.

## 1. Healthcare & Medicine

### Applications:

Personalised treatments based on individual DNA. Early detection of diseases through genetic screening. CRISPR: A powerful gene-editing tool to correct faulty genes.

## 2. Agriculture

### Applications:

**GMO Crops** (Genetically Modified Organisms): Engineered to resist pests, diseases, and drought.

**Gene Banks:** Help conserve and protect endangered plant species.

### 3. Forensics & Justice

Applications:

Solving crimes using DNA fingerprinting.  
Identifying missing persons and disaster victims.

### 4. Environment & Conservation

**Applications:**

**DNA Barcoding:** Tracks and identifies endangered species.

**Genetic Tools:** Prevent the extinction of rare species. Monitoring biodiversity and the impacts of climate change.

### The Future of DNA Technology

DNA science will shape our world in areas such as

1. Disease prevention
2. Customized nutrition
3. Green energy and biofuels
4. Synthetic biology (creating new life forms)

### DNA and Agriculture:

#### Dr. M.S. Swaminathan

Known as the Father of the Green Revolution in India. During the Bengal Famine of 1943, As a young man, he witnessed the devastating famine that killed millions. This left a lasting impression and motivated him to work toward food security in India. Helped India become self-sufficient in food grain production.



Focused on sustainable agriculture and farmer welfare. Awarded the World Food Prize in 1987, Padma Shri (1967), Padma Bhushan (1972), Padma Vibhushan (1989). Nobel Laureate Dr Norman Borlaug collaborated closely with Borlaug and was inspired by his work on high-yielding wheat varieties. This helped him develop similar strategies for India.

#### Subhash Palekar

Pioneer of Natural Farming. He developed Zero Budget Natural Farming (ZBNF). Encourages farmers to use no chemical inputs, only natural ones from local sources. Inspired lakhs of farmers across India. Awarded Padma Shri in 2016.

#### Gauri Devi

Champion of Women in Agriculture (from Uttarakhand). Known for organising women farmers and promoting community forest conservation. She turned barren hills green through traditional farming and community work.

#### Kamala Pujari

Tribal Organic Farmer from Odisha. Preserved traditional seeds and organic farming techniques. Promoted indigenous farming and food diversity. Received Padma Shri in 2019.

### Use of DNA for farmers in crops

#### 1. DNA helps to choose better seeds:

Scientists study the DNA of plants to identify genes responsible for traits like bigger fruits, higher yield, drought resistance and pest resistance, helping farmers grow healthier, stronger, more productive crops and improve long-term food security while reducing farming risks, costs, and dependence on chemical inputs, especially under changing climate conditions.

## 2. Animal Breeding

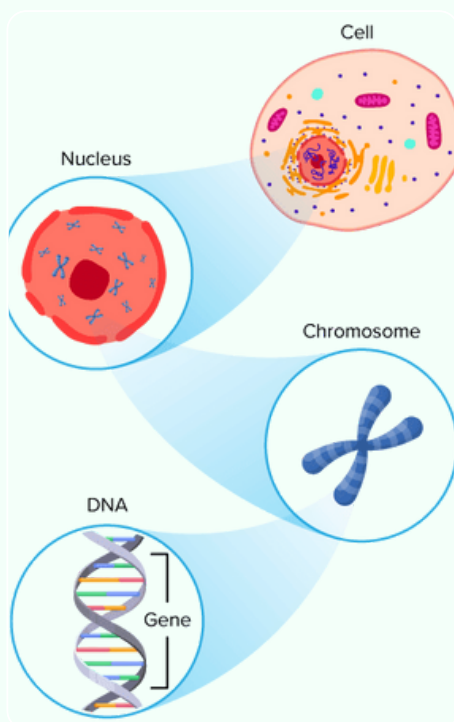
Farmers use DNA tests to select animals (like cows or goats) with the best traits to give more milk, faster growth and disease resistance.

## 3. Flower breeding

Flowers are grown for medicines, decorations, flavourings, fragrances, perfumes, the oil industry and other uses. The floriculture industry is experiencing rapid growth, with advancements in technology enhancing flower cultivation and distribution.

## 4. Marine Biology:

It is a study about the ocean, including oysters, corals and other living organisms, as well as marine ecosystems. Marine biology helps students understand the importance of oceans for climate, biodiversity and human life.



## DNA and Health:

Some diseases are linked to **changes in DNA**:

- Thalassaemia
- Sickle cell anaemia

- Certain cancers
- Diabetes (genetic risk)

In India, doctors now use **genetic screening** to:

- Detect diseases early
- Plan better treatments
- Advise families on preventive care

This is called **personalised medicine**, where treatment depends on a person's DNA.

## DNA and Innovation:

DNA is now compared to data.

Scientists are exploring:

- DNA as a **data storage system**
- Combining DNA studies with **AI**
- Using computers to analyse genetic patterns

This creates **interdisciplinary careers**:

- Bioinformatics
- Computational biology
- Genetic data analysis

## DNA and Climate Change Solutions

DNA research helps in:

1. Developing climate-resilient crops
2. Protecting endangered species
3. Preserving biodiversity
4. Understanding how organisms adapt to change

DNA teaches young innovators that small things can have a huge impact, showing how science works best when applied to real problems. Evidence matters more than belief, and innovation must serve society responsibly. DNA is not just inside your body; it is inside India's future. Every discovery in DNA science begins with curiosity, careful observation, questioning, and the courage to explore the unknown with imagination and responsibility.