

1. Biosecurity- Science & Technology

India needs to upgrade its biosecurity measures. Rapid advancements in biotechnology and the rising threat of biological misuse by state and non-state actors have made strengthening India's biosecurity framework a national priority. India must modernize its fragmented legal and institutional architecture to address unique vulnerabilities in public health, agriculture, and dual-use research.

The Rising Threat

Rapid advancements in biotechnology have inadvertently escalated the risks associated with biological agents. The potential for deliberate misuse by state and non-state actors has made the strengthening of India's biosecurity framework a critical national security priority.

Biosecurity

Biosecurity constitutes a comprehensive defence mechanism against biological threats.

Definition- It refers to a strategic set of policies, practices, and institutional systems specifically designed to prevent the intentional misuse of biological agents, toxins, or biotechnologies.

Key Mandates

Safeguarding Laboratories- Strict oversight of facilities handling dangerous pathogens.

Access Control- Preventing unauthorized access to sensitive biological materials.

Outbreak Management- Detecting and responding to deliberate disease outbreaks.

Scope- The domain of biosecurity is not limited to human health; it extends to protecting animal health and plant health to ensure ecological and agricultural stability.

Biosecurity vs. Biosafety

While related, these two concepts serve different purposes. A robust biosafety regime is the foundation for effective biosecurity.

Feature	Biosecurity	Biosafety
Primary Focus	Prevention of intentional misuse (theft, terrorism).	Prevention of accidental release or exposure.
Threat Source	Malicious actors (insiders, terrorists, state actors).	Unintended errors, negligence, or equipment failure.
Objective	Securing biological agents against theft or diversion.	Protecting workers and the environment from harm.

Biosecurity Is Critical for India

India's specific socio-economic conditions make it uniquely vulnerable to biological threats.

Demographic Vulnerability

Population Density- India's large population and high density mean that any biological incident could spread rapidly, causing massive human impact.

Economic & Agricultural Risks

Agro-Terrorism- The country's heavy dependence on agriculture and livestock makes it a prime target for agro-terrorism.

Transboundary Diseases- Vulnerability to infectious diseases crossing borders can devastate the rural economy and food security.

The Dual-Use Dilemma

Research Regulation- Rapid growth in the biotechnology sector poses challenges in regulating "dual-use" research—technologies intended for civilian good that can be weaponized.

Asymmetric Threats

Non-State Actors- Terrorist groups have shown interest in low-cost, high-impact biological agents.

Recent Incidents- There have been alarming reports regarding the alleged preparation of Ricin (a deadly toxin derived from castor oil) for potential terror attacks.

India's Existing Biosecurity Architecture

India currently manages biosecurity through a mix of institutional bodies and legal statutes.

Institutional Mechanisms

Department of Biotechnology (DBT)- The nodal agency for research governance and safety

frameworks in laboratories.

National Centre for Disease Control (NCDC)– Responsible for surveillance of disease outbreaks and coordinating response efforts.

Department of Animal Husbandry and Dairying– Monitors livestock biosecurity and manages transboundary animal diseases.

Plant Quarantine Organisation of India– Regulates agricultural imports and exports to prevent the entry of exotic pests.

National Disaster Management Authority (NDMA)– Has issued comprehensive guidelines for managing biological disasters.

Key Legal Instruments

The Environment (Protection) Act, 1986– The umbrella law governing the handling of hazardous microorganisms and genetically modified organisms (GMOs).

The WMD Act, 2005– *The Weapons of Mass Destruction and Their Delivery Systems (Prohibition of Unlawful Activities) Act* explicitly criminalizes the manufacture, possession, or transport of biological weapons.

The Biosafety Rules, 1989– Along with 2017 guidelines, these regulate recombinant DNA research and biocontainment protocols.

International Measures

India is a participant in global frameworks designed to curb biological warfare.

Instru- ment	Biological Weapons Convention (BWC)	Australia Group
Scope	Multilateral Disarmament Treaty.	Informal Forum of Countries.
Timeline	Entered into force in 1975.	Established to counter proliferation.
Mandate	Prohibits development, production, acquisition, transfer, stockpiling, and use of biological and toxin weapons.	Seeks to prevent proliferation by harmonising export controls on dual-use materials and technologies.
Status	First treaty to ban an entire category of WMDs.	Focuses on chemical and biological weapon prevention.

Global Best Practices

Leading nations have integrated biosecurity into their national defense strategies.

United States– Anchors its framework under the National Biodefense Strategy (2022–2028), integrating health, defense, and biotech oversight.

China– Enacted the Biosecurity Law (2021), which classifies biotechnology and genetic data as national security assets, mandating centralized control.

United Kingdom– Implementation of the Biological Security Strategy (2023), with a sharp focus on bio-surveillance and rapid response capabilities.

Way Ahead

To future-proof the nation against biological risks, India must undertake the following strategic reforms–

Unified National Framework– Establish a comprehensive national biosecurity framework with clear leadership to eliminate fragmented coordination.

Regulatory Updates– Modernize legal systems to effectively regulate emerging fields like synthetic biology and dual-use research.

Technological Investment– Significantly enhance capabilities in

1. Genomic Surveillance– To track pathogen mutations.
2. Microbial Forensics– To attribute the source of attacks.
3. Early-Warning Systems– To detect threats before they escalate.

Source– https://www.thehindu.com/sci-tech/science/does-india-need-to-upgrade-its-biosecurity-measures-explained/article70400364.ece#google_vignette