Gain-of-function Research

Why in News

The **Wuhan Institute of Virology** was said to have conducted **gain-of-function research** on coronaviruses which may possibly have caused the lab-leak origin of the **SARS-CoV-2 (**Covid-19 **pandemic).**

Key Points

- **Gain-of-function Research:**
  - **About:**
    - In virology, gain-of-function research involves **deliberately altering an organism in the lab, altering a gene,** or **introducing a mutation** in a pathogen to study its transmissibility, virulence and immunogenicity.
    - This is done by genetically engineering **the virus** and by allowing them to grow in different growth mediums, a technique called **serial passage.**
      - **Serial Passage** refers to the process of growing bacteria or a virus in iterations. For instance, a virus may be grown in one environment, and then a portion of that virus population can be removed, and put into a new environment.
  - **Significance:**
    - This would allow researchers to study **potential therapies** and **ways to control the disease** better in future.
    - Gain-of-function studies, which enhance viral yield and immunogenicity (relating to immune response), are **required for vaccine development.**
- **Issues:**
  - Gain-of-function research involves manipulations that make certain pathogenic **microbes more deadly or more transmissible.**
  - There is also **'loss-of-function' research,** which involves **inactivating mutations,** resulting in a **significant loss of original function,** or no function to the pathogen.
    - When mutations occur, they **alter the structure** of the virus, resulting in **altered functions** which might weaken the virus or enhance its function.
  - Gain-of-function research reportedly carry inherent **biosafety and biosecurity risks** and are thus referred to as **'dual-use research of concern' (DURC).**
    - This indicates that while the research may result in benefits for humanity, there is also the potential to cause harm — accidental or deliberate escape of these altered pathogens from labs may even cause pandemics (Like it is said to be in case of **Covid-19**).
- **Situation in India:**

- All activities related to genetically engineered organisms or cells and hazardous microorganisms and products are regulated as per the **“Manufacture, Use, Import, Export and Storage of Hazardous Microorganisms/Genetically Engineered Organisms or Cells Rules, 1989”.**
- In 2020, the Department of Biotechnology issued guidelines for the establishment of containment facilities, called **‘Biosafety labs’.**
    - The notification provides operational guidance on the **containment of biohazards and levels of biosafety** that all institutions involved in research, development and handling of these microorganisms must comply with.

- **Debate over Gain-of-function:**
    - **Proponents:**
        - It makes science and governments **battle-ready for future pandemics.**
        - Proponents of gain-of-function research believe that “nature is the ultimate bioterrorist and we need to do all we can to stay one step ahead”.
    - **Critic:**
        - After the Covid-19 pandemic, more concerns are raised on carrying out such kinds of research.
        - This may cause the extinction of the living things or may change their genetic makeup forever.

Way Forward

- The **World Health Organization (WHO)** should lead activities on DURC.
- There should be **responsible use** of life sciences research, focusing on mitigation and prevention of bio-risks and associated ethical issues.
- Develop a **Global Guidance Framework for** countries to follow.
- There is a need to ensure greater transparency about such research.

Source:TH