Science & Technology · GS - III

What is the basic principle behind vaccine development? How do vaccines work? What approaches were adopted by the Indian vaccine manufacturers to produce COVID-19 vaccines?

EXAM YEAR	PAPER	SUBJECT
2022	GS - III	Science & Technology

MARKS	WORD LIMIT
15	~250 words

Answer Hint

Vaccines train the immune system to recognise specific pathogens or their antigens and develop immunological memory. COVID-19 vaccine development used multiple platforms, including inactivated viruses, viral vectors, DNA and protein subunits. Platform diversity enabled faster development while requiring evidence of safety, efficacy and manufacturing quality.

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Model Answer

Introduction

Vaccines prevent infectious diseases by stimulating an immune response without requiring the person to experience the full disease.

Principle and Mechanism

Vaccines expose the immune system to an antigen or genetic instructions for producing it. The body develops antibodies and activates immune cells, including memory B and T cells. On subsequent exposure to the pathogen, this immune memory enables a faster and stronger response, reducing the risk of severe disease.

Approaches Adopted in India

1. Inactivated Virus: Bharat Biotech’s Covaxin used chemically inactivated SARS-CoV-2 to stimulate immunity.

2. Viral Vector: Serum Institute of India's Covishield used a modified adenovirus vector carrying instructions for the coronavirus spike protein. Sputnik V also used viral-vector technology.

3. DNA Vaccine: Zydus Lifesciences' ZyCoV-D used plasmid DNA encoding the spike protein.

4. Protein Subunit: Biological E's Corbevax used a recombinant spike-protein antigen with an adjuvant to enhance immune response.

5. Other Platforms: Indian research and manufacturing efforts also explored mRNA and other vaccine technologies.

Conclusion

India's use of multiple vaccine platforms strengthened its pandemic response and manufacturing capacity. Continued research, rigorous clinical trials, safety monitoring and equitable distribution remain essential for effective immunisation.

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