Science & Technology · GS - III

What are the research and developmental achievements in applied biotechnology? How will these achievements help to uplift the poorer sections of the society?

EXAM YEAR	PAPER	SUBJECT
2021	GS - III	Science & Technology

MARKS	WORD LIMIT
15	~250 words

Answer Hint

Genetic engineering, recombinant DNA technology, vaccines, diagnostics, tissue culture, biofertilisers, biopesticides, genetically modified crops, disease-resistant varieties, bioinformatics, affordable healthcare, agricultural productivity, nutritional security, biofuels, biosafety, equitable access

Model Answer

Introduction

Applied biotechnology uses biological systems, organisms and molecular techniques to develop products and processes in healthcare, agriculture, industry and environmental management. It can improve productivity and expand access to essential services.

Major Research and Development Achievements

- **Healthcare:** Recombinant insulin, molecular diagnostics, improved vaccines and biotechnology-based medicines have strengthened disease prevention and treatment.
- **Vaccines and diagnostics:** Advances in biotechnology supported rapid development of vaccines and diagnostic platforms during the COVID-19 pandemic.
- **Agriculture:** Tissue culture, marker-assisted breeding and genetically engineered crops have enabled the development of varieties with useful agronomic traits.

- **Biofertilisers and biopesticides:** Biological alternatives can reduce dependence on some chemical inputs and support soil health when appropriately used.
- **Industrial biotechnology:** Enzymes, biofuels and microbial processes offer opportunities for cleaner manufacturing and waste treatment.
- **Bioinformatics:** Computational analysis of biological data accelerates research into diseases, crops and genetic resources.

How Poorer Sections Can Benefit

- **Higher farm incomes:** Improved planting material and disease-resistant crops can reduce losses and increase productivity.
- **Affordable healthcare:** Locally developed diagnostics, vaccines and biologics can improve access to essential treatment.
- **Nutrition:** Biofortified crops and improved food production can help address micronutrient deficiencies.
- **Employment:** Biotechnology-based enterprises can create skilled and semi-skilled jobs in rural and urban areas.
- **Environmental benefits:** Appropriate biological inputs and waste-treatment technologies can reduce certain forms of pollution and improve resource efficiency.

Challenges and Safeguards

High research costs, intellectual property barriers, limited laboratory infrastructure and unequal access can prevent benefits from reaching poorer communities. Biosafety, biodiversity protection, informed regulation and independent evaluation are essential.

Conclusion

Biotechnology can contribute to poverty reduction when research is translated into affordable products, supported by public investment, local capacity, responsible regulation and equitable distribution.

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