

Q-1 How can Indian pharmaceutical industry benefit from advancements in biotechnology and what specific steps can be taken to encourage innovation and investment in this field? Discuss.

Approach

In this question candidates need to write about how Indian Pharmaceutical industry is benefited from biotechnology, In second part write about which steps have been taken to encourage innovation in this field.

Introduction

Biotechnology plays a very vital role in Pharmaceutical Research and Development sector. In today's time, 15% of the bounce is elicited from the bio pharmaceutical industry. Many steps has been taken to improve innovation and investment in this field .

Body

Biotechnology is the science that merges with technology that is being used in the pharmaceutical industry and it is proven to be advantageous specifically in the manufacturing of genetic testing and vaccinations.

Importance of biotechnology in the field of Pharmaceutical Industry

- Pharmaceutical companies are highly working towards the production of medicines and lifesaving vaccines for the entire global community. And when the pharmaceutical industry uses the advances of biotechnology and its sophisticated techniques, the result is better and faster delivery of drugs. Biotechnology has contributed to the Pharma industry for the preparation of vaccines and medicines in an accurate manner.
- Biotechnology has helped the Pharma industry in the development of better processes, new products, and also has come up with new technologies to improve the existing methods. Thus, biotechnology when combined with the pharmaceutical industry can introduce a large number of jobs at the international level. some of the fields of the Pharmaceutical industry where biotechnology has played a vital role-

Vaccination:

- Today, when the world is fighting with the fear of Corona-virus and all our hopes stand united on the development of the COVID-19 vaccine. It can be well understood about how much the vaccination industry demands the expenditure of resources.
- The pharmaceutical industry strives to manufacture products that are beneficial in fighting various diseases. Some diseases can still not be cured by medication, therefore the concept of vaccination came into the picture. The most relevant indication is metabolic, oncology disorders of the musculoskeletal system, and for the near future, it can be anticipated that the relevancy of the bio-pharmaceutical sector will be a boom.

Genetic Testing:

- Genetic testing is a form of medical test that specifies the changes in chromosomes, proteins, or genes of an organism. The result of a genetic test can verify or rule out an expected genetic condition or help deduce a person's chance of developing or enacting on a genetic disorder. More than 1,000 genetic tests are presently in use, and further are being formulated.

Various methods can be obtained for genetic testing:

- Molecular genetic tests study solitary genes or short lengths of DNA to specify variations or modifications that steer to a genetic disorder.
- Chromosomal genetic tests help in the analysis of entire chromosomes or the long lengths of DNA to identify the occurrence of huge genetic changes such as an additional copy of a chromosome, that induces a genetic condition.

Biochemical genetic tests research

- Biochemical genetic tests research the proportion or activity level of proteins; abnormalities in either can imply changes to the DNA that result in a genetic syndrome.
- Genetic testing is instinctive. Because testing has advantages as well as restrictions and risks, the decision about whether to be tested is a subjective and difficult one. A geneticist can assist by giving information about the pros and cons of the test and examining the social and emotional factors of testing.

Need of the Innovation in Pharma Sector

- Changing perspective and increasing the use of technology were the need of the hour. But now it is essential that innovation is at the core of business, and there is a dire need to embrace it if India wants to continue to be of relevance in the global pharmaceutical space.
- India playing at scale in the innovation space will not just help the country but will create a source of sustainable revenues, bringing new solutions to unmet healthcare needs.
- In India, this would lead to reduction in disease burden (development of drugs for India-specific concerns like tuberculosis and leprosy does not get global attention), creation of new high-skilled jobs, and probably around USD 10 billion of additional exports from 2030.
- Countries like China have already leapfrogged ahead, skipping the generic medicine based development.

Way Forward

- Robust Regulation: An enabling regulatory structure with simplified processes, robust guidelines, predictability, increased capacity and strong governance.
- India needs a 60% reduction in the approval timeline to be competitive.
- Robust Funding Support with government aid for industry investment through policies/incentives, direct government investment, and significant private investment.
- India offers an attractive set of benefits — weighted R&D deduction, additional patent box benefits, and progressive policies to increase innovation funding which can attract more investment.
- Industry-Academia Linkages: Strong linkages between academia and industry with high quality academic talent and infrastructure, industry-oriented research, and strong governance.

- India needs world-class centers of excellence to attract global talent and support cutting-edge research.
- Hubs to Accelerate Collaboration: There is a need for several at-scale innovation hubs co-locating academia, public R&D centers, industry, start-ups and incubators.
- Invest in Other Modern Sectors: India should look up to and invest in biotechnology. India's biotechnology industry, comprising bio pharmaceuticals, bio-services, bio agriculture, bio-industry and bio-informatics is expected to grow at an average rate of around 30% a year and reach USD 100 billion by 2025.

Conclusion-

The biotechnology and pharmaceutical sectors have showcased resilience and grit in the face of the pandemic, continuously evolving and innovating for better outcomes. The next story of the Indian pharmacy industry has to be one centred around biotechnology and innovation. If the right choices are made and if nurtured right then investment will come and India can grow to be leaders in the global pharmaceutical market.

Q.2 What are the potential applications of nanotechnology in the field of healthcare in India and how can policies and infrastructure be developed to promote research and development in this area? Examine.

Approach

Start with basic intro on nanotechnology and then linking it with health sector write about application and also highlight relevant policies and infrastructure facilitated by government.

Introduction

Nanotechnology is the understanding and control of matter at the nanoscale, at dimensions between approximately 1 and 100 nanometers, where unique phenomena enable novel applications.

Body

- Nanomedicine applies nanotechnology in healthcare applications such as treatment and diagnostics of various diseases using nanoparticles in medical devices, as well as nanoelectronic biosensors and molecular nanotechnology.

Application of nanotechnology in health sector:

- Health monitoring: With increasing life style disease and diabetic patients in India nanotubes and nanoparticles can be used as glucose, carbon dioxide and

cholesterol sensors and for in-situ monitoring of homeostasis, the process by which the body maintains metabolic equilibrium.

- Nanofibers: With high number of disable population in India nanofibers can be used in wound dressings and surgical textiles, as well as in implants, tissue engineering, and artificial organ components.
- Disease diagnosis: It can be done using quantum dots nanosized semiconductors that can be used as biosensors to find disease and which can be made to fluoresce.
- For example, nanotechnology-based tuberculosis diagnostic kit would cut both the cost and time required for most prevalent TB tests in India.
- Targeted Drug Delivery System: Researchers are working on a number of different therapeutics where a nanoparticle can encapsulate or otherwise help to deliver medication directly to cancer cells and minimize the risk of damage to healthy tissue.

Concerns of using nanotechnology:

- Lack of proper knowledge about the effect of nanoparticles on biochemical pathways and processes of the human body.
- Expensive processes and treatments make them less desirable.
- Toxicity: Scientists are primarily concerned about the toxicity, characterization, and exposure.

Policies and infrastructure to promote:

- Institute like IISC, IITs can work on Nanotech detectors for heart attack and nanochips to check plaque in arteries.
- National Centers for Nanofabrication and Nanoelectronics can be established.
- Much larger funding and efficient policies for capacity building in fields of basic research in nanotechnology, infrastructure development, human resources development, and global collaboration can be done.

Conclusion

Nanotechnology helps to overcome the limitations of conventional dosage forms. This technology promises to be used in disease treatment as well as diagnostics with high efficacy. Meanwhile there is a need to identify key gaps in knowledge and areas where further research may be targeted in order to efficiently exploit the technology.

Q.3 How can India's manufacturing and industrial sector be modernized and automated through the incorporation of robotics and what are the key challenges that need to be addressed to achieve this? Analyse.

Approach

Candidates can start the answer by basic definition of robotics and its application, in later part try to explain how it can transform Indian manufacturing and Industrial space. In the end highlight few challenges.

Introduction

Nowadays Robots are now widely used in manufacturing, assembly, packaging, mining, mass production of consumer and industrial goods etc. Basically, Robotics is the branch of technology that deals with the design, construction, operation, structural depositions, manufacture, and application of robots.

Body

Modernizing and automating Indian manufacturing and Industrial sector:

- Automobile: Industrial Robots due to their speed accuracy, reliability & endurance are readily used in the manufacturing of cars. Tasks such as welding, spray painting welding, material handling & assembling can be performed better by an industrial robot than a human.
- Electronics: Pick & place robots are used in the mass production of the printed circuits boards (PCB's). They help in removing tiny electronics components from strips & trays & place them onto PCBs with great accuracy.
- Such robots can place several components per second far outperforming a human in terms of speed, accuracy & reliability.
- Packaging Industry: Extensively used for palletizing & packaging of manufactured goods. For example, taking drink cartoons from the end of the conveyer belt & placing them rapidly into boxes.
- Mining: Due to the hazardous nature of mining, in particular underground mining, the prevalence of autonomous, semi-autonomous, and teleoperated robots has greatly increased in recent times.

Challenges of Robotics in India:

- The cost of adopting Robotic technology is very high due to the cost of procuring imported hardware components as well as training personnel. As Robotics is a multidisciplinary field, acquiring and retaining quality talent is a big issue.
- There is a scarcity of good faculty to teach the subject: Barring a few regions in India, Robotics as a subject is not taught well to engineering students.
- Creating jobs is important for socio-economic reasons in India. The government's strategy to address the jobs issue has been to absorb a large labour force by promoting the manufacturing sector.
- However, with increasing automation and concerns of companies shifting their manufacturing base as economic consideration of cheap labour is done away, the government's strategy is at stake.

Conclusion

Robots are soon going to be a part and parcel of human life. In reality, the advancement in the field of robotics has both a good side and a bad side. Hence it is up to us humans to understand the safe limits of inventions and utilise robotic services in specific and judicious ways.

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