



NEGLIGIBLE DRUG DISCOVERY IN INDIA: A REVIEW

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Abstract: India is the country with the biggest consumption of generic medications. Not Withstanding the rarity of novel medicinal compounds. India was prosperous with various drugs and their knowledge of therapeutic use in ancient times but it was not inherited to us so efficiently, as in modern age India had not developed novel drug molecules significantly. India may have a lot of resources for discovering new drugs, but those are insufficient. Researchers face several difficulties including financial support, Non Innovative Mentality, government regulations, laws, and approval delays. Our researchers also play a significant role in those who have the mindset to modify the physical or chemical properties of already known medicinal molecules. We will discuss many factors influencing drug discovery in India in this review paper, as well as the actions that should be taken to improve this situation.

Keywords: Drug Discovery, Innovation, Finance, Artificial Intelligence, Ayurveda, Research and Development, Laws

INTRODUCTION

History of Drug Discovery in India

The process of discovering new drugs is a lengthy one that can last up to more than 10 years. Typically, screening for potentially active compounds is the first step in the early drug discovery process. Following their discovery, these substances are tested for safety and efficacy. They must have a therapeutic effect on the intended ailment. Approximately 1 out of every 5,000 medications typically reach the level of market approval. In addition, the chances of being selected for clinical trials of a drug is very less as well as further marketing is also a difficult phase. In past few decades we have totally extracted compounds with therapeutic activities from natural resources, but now a days we have moved on to synthetic compounds.

These synthetic compounds are synthesized by various techniques like computational and combinatorial techniques and advances in biotechnology. Many plants utilised in the Indian medical system have recently undergone contemporary analytical analysis, and the active components have been identified. In an effort to find more effective leads, significant medicinal chemistry work is being done with these compounds.

1. Drug discovery in Ayurveda

In India in Ancient times Synthetic compound were not discovered, that's why those people derived Drugs from mainly 3 sources are as follows

1.1 Mineral Sources

1.1.1 Red Sulphide

Ancient Indians interested in the red mercury sulphide known as rasasindur, also known as rasasindura, rasasindoor, rasasinduram, sindur, or sindoor in ancient Indian literature since it is widely used to treat a variety of illnesses and diseases. Following a number of physico-chemical analyses, it is determined that rasasindur is chemically pure -HgS with a 1:1 Hg:S ratio. Transmission Electron Microscopy (TEM) analysis of rasasindur revealed that the particles are tiny. Rasasindur's biochemical studies were also made clear, it works as a protease inhibitor by preventing trypsin from breaking down BSA. It also displayed some modest antioxidant qualities. Small compounds that have the capacity to block proteases may stop unintended cell harm and function as a treatment for illnesses brought on by excessive proteolysis. Since rasasindur is a component of the conventional Indian medical system.

1.1.2 Alum

Alum (Phitkari) is employed in Ayurveda as Sphatika Bhasma, a kind of Bhasma (Pure Ash). By lowering the buildup of mucus in the lungs, the Sphatika Bhasma is used to treat whooping cough in conjunction with honey. Due to its drying properties, taking Alum Bhasma twice daily may also help with diarrhoea and dysentery. Women have always used alum and wax to remove unwanted hair, being an astringent alum gives rise

1.1.3 Arsenic

Metalloid arsenic has been utilised as a poison and a medicine since ancient times.

1.1.4 Borax

Suhaga is also renowned for having variety of advantageous characteristics as follows

- It might have antioxidant properties.
- It might have digestive properties.
- It might have anti-Inflammatory qualities.

2. Factors Affecting Drug Discovery in India

Research and development is a risky sector to invest as the chances of drug of being selected and then market approval is too hard process and India is one of country which don't want to take the risk at all and we are also not ready for the time investment in it. India also lack of good quality of infrastructure we needed for research facility. The need to improve the scientific education system is one of the fundamental issues that must be addressed. Internal problems including poor facilities and instruction, red tape, and political interference can give rise to some worries. The majority of people still consider current collaborations between industry and academia or public research institutions to be "limited," and only 10% consider them to be "good." This lack of interest in "applied science," mistrust, or different priorities and KPIs, such as academic papers versus patents and commercialization in industry, are among the causes of these perceptions. It is necessary to increase overall R&D investment, especially in NCE drug discovery, as it has been falling far short of the global industry norm.

There has to be an increase in adequately supported biotechnology companies. Indian education system is not good enough to support students to collaborate with big research institutions, to get enough knowledge regarding research and innovation. Students are not intended to do something new. Collaboration between 2 research institutes is negligible as they place competition ahead of doing something better by coming together as every institute is not fulfilled with everything, it is impossible to get desired results in designated time and finally both of them will give up. India need to do better by involving different companies, some computational, biotechnological advances and innovative minds of the researchers.

2.1 Financial condition

2.1.1 Factors Influencing Research and Development Spending.

There are various factors responsible for R&D spending's from the government laws and policies to cost required for research and development:

- 1) Revenue generated and money invested to develop that drug, laws governing the cost and supply of drug and most importantly the demand of drug.
- 2) The drug being developed is not marketed only in a single country, it is going to distribute all over the world. The acceptance of price in different market may be different which also influence the global revenue of new drug.

Positive developments include formation of the National Organization for Rare Diseases, the Orphan Drug Act, the development of a grant program to fund orphan drug development, the formation of the National Institutes of Health Office of Rare Diseases, and the passage of orphan drug legislation. Investors hesitate to invest in such a low return on investment research and development model. The financial condition is so bad that companies need to raise the fund from orphan drugs.

According to the Orphan Drug Act, investment is given to develop the Orphan drugs needed for orphan diseases which are rarely occurring. Businesses situated in the United States (US) spent 71 times more on R&D as compared to Indian listed companies in 2019. Similarly, EU businesses spent 38 times more, and Chinese and Japanese businesses spent nearly 24 times more than Indian entities.

R&D Rank	Country/Region	R&D Spending (2019 in million euros)
1	United states	347664.076
2	European union	188879.0
3	China	118809.9
4	Japan	114867.9
NA	India	4866.4

Table 1.1 R&D spending on Drug Discovery in various countries in million euros.

2.2 Lack of Innovation

Collaboration between public and private businesses must be promoted so that India's infrastructure, human capital, and cultural foundation can support life science discoveries. Government funding is a strategic necessity, but the procedures used to make these decisions are still archaic. The government has established numerous grants, loans, and other programmes to support sound research. The Council of Scientific and Industrial Research's New Millennium Indian Technology Leadership Initiative (NMITLI) and Open Source Drug Discovery (OSDD) as well as the Department of Biotechnology's Biotechnology Industry Research Assistance Council/Biotechnology Industry Partnership Program (BIRAC/BIPP) are just a few of the commendable initiatives being carried out by various government science departments that aim to close the gap between publicly funded research and PR. Drug discovery programmes have led to the identification of important lead compounds and formulations by numerous publicly funded institutions.

Creating a plan with no restrictions for thriving invention: We must acknowledge that cross-functional teams of entrepreneurs, scientists, and regulators will produce the best NCE innovations. Failures in business, scientific, or regulatory processes must occur in a setting where they serve as a springboard for new ideas rather than the team's demise. The Indian pharmaceutical industry has followed a trajectory from duplicative imitation to creative imitation to move up the value chain of pharmaceutical R&D. Finally as a result of changes in patent law the industry is learning to develop capabilities in innovative R&D. The basic and intermediate technological capabilities gained from imitative learning gave these, we used to copy the previously established drugs and made some changes in them to get a new drug until Patent Act 2005, which completely changed the way of drug discovery and now we are learning to develop the novel drugs by ourselves.

2.3 Collaboration

The second most significant issue brought up is collaboration, which is the hardest obstacle to overcome in the current system. The majority of us continue to believe that anything is possible if our institutions work seamlessly together; all that is required is the determination to make it happen. If such a solid performance platform is developed, it will also encourage/attract the pharmaceutical business to jump on board, with results becoming apparent in 5–10 years. It is necessary to consider the idea of creating a completely new regional drug policy to protect the regional interests of the SARC members. It's time to push the horse ahead of the cart and implement a new work culture for drug research and development.

2.4 Lack of Specialized Technology

In recent years Artificial Intelligence has played an important role in drug discovery in away countries, But in India AI is not used sufficiently. AI could help pharmaceutical companies get drugs to market more quickly. Today, AI is being trained to forecast medicine efficacy and adverse effects, manage the enormous volumes of paperwork and data required to support any pharmaceutical product, in addition to doing spectacular gene-sequencing work.

Companies are utilizing AI and ML to speed up the medication development process, catching up to the west in this regard. If we compare the total use of AI and related technologies in hastening the drug development processes, it is clear that there has been a huge growth with many companies around the world forging ahead in this field. But there is still more work to be done in the Indian context. While AI development in India is coming up, a significant gap still has to be closed before effective drug development can take place.

2.5 Lack of skilled Professional

High-caliber scientists and engineers are in high demand nowadays due to the quick advancement of scientific knowledge. The disparity between the talents required by India and those that are now accessible is widening. In India, there are plenty of people with a wide range of skills available, but there is a significant shortage of talent in highly skilled fields. India has one of the lowest scientific workforce densities, ranking even lower than Chile and Kenya when it comes to research workforce density in the labour population, with just 200,000 researchers in a nation of over 1.2 billion people. Institutions (104th) and infrastructure (114th) were the country's low rankings on the innovation sub-indices in the Global Innovation Index (GII) 2015 report (87th). 47 According to the report, India's higher education system is currently plagued by low teacher quality, limitations on research capacity and innovation (due to a low enrollment in PhD programmes, a lack of opportunities for interdisciplinary work, a shaky innovation ecosystem in academia, and low industry-university collaboration), and a significant socioeconomic divide.

3. Laws affecting on Drug Discovery in India

3.1 Patent Act 1970

This law does not encourage companies to work on research and development, which directly affects drug discovery. The Indian Patents Act was passed at the beginning of the 1970s by the Indira Gandhi administration to enable the country's impoverished to have easier access to medications at reduced costs, there were patents for the process of drug discovery, but not patents for products, would be recognized under the Act. If expressed differently, India would grant patents on the method used to make the drug rather than the specific drug itself. This enabled Indian pharmaceutical businesses to produce the same medication using different techniques (this is otherwise known as reverse engineering). New pharmaceuticals could be made available to the nation at reasonable prices because Indian companies spent little money on their creation and research.

3.2 The patent Amendment law 2005

The Product Patent regime in India was made possible by this Amendment. The Product Patent regime entered India for the first time at this period. The product patent would encourage businesses to invest more in research and development. The R&D would benefit from this. Many new drugs may be developed in the future that will significantly affect the nation's population's health. As a result, numerous life-saving drugs would be developed. The nation's public health will benefit from this. The new patent regime offered product patents together with other safeguards. Foreign multinationals would have opportunity to enter India and grow their businesses thanks to the new patent framework.

Future aspects

Collaboration between academia and industry is only possible if academic institutions prioritize producing high-caliber research that meets market needs. Even though certain institutions still have pockets of academic and clinical competence, we continue to lose our best young minds to the west. In order to draw in the greatest personnel available and remove administrative barriers, and we must examine the compensation packages offered by our leading scientific institutes.

Artificial Intelligence is very effective in the discovery of drugs, Novartis a foreign pharma company recently collaborated with the tech giant Microsoft to use AI more efficiently. Indian businesses should invest more in AI to increase their efficiency.

Conclusion

Despite all these obstacles, the government is supporting these institutions by enabling the private sector to partner with them and participate in their work. The Amendment Law of 2005, which forbade Indian corporations from copying already-available drugs and creating new versions of them, is revolutionary in launching drug research in India. As a consequence, businesses now focus on discovering innovative drugs. The most alluring features that Indian institutions offering their low costs, skilled trial and IT management personnel, rich resource pool of clinicians trained in Good Clinical Practice (GCP), large patient pool suffering from diseases like diabetes, cancer, hypertension, asthma, tropical infections, and degenerative diseases, high patient-to-doctor ratios, world-class training in research and documentation, etc.

Now, India is emerging as new research and development hub in the world.

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