

DEVELOPMENT OF PHARMACEUTICAL INDUSTRIES WITH SPECIAL REFERENCE TO COLONIAL INDIA

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Abstract : Since time immemorial, India had its own enriched tradition, heritage and natural wealth. Reflections of development are evident in Indian civilization in different aspects of life like art, architecture, geometry, mathematics, astronomy and medical science. Along with the development of different scientific traditions, development of alchemy and its application for human welfare was also an important foot step in Indian scientific tradition. In this connection, the development of pharmaceutical industries comes naturally as an integral part of alchemy.

Keeping this backdrop in mind, the aim of the present endeavour is to understand the history and development of pharmaceutical industry in colonial India. Here the development of 'pharmaceutical' industries is an illuminating lens which enables the present researcher to understand the interaction and interrelation between Indian traditions of thought and western science and the subsequent development of the pharmaceutical industries during colonial period in the Indian subcontinent. Therefore, the above aim will be highlighted through the following objectives – (i) to understand the nature of development of pharmaceutical industries in the West? (ii) What kind of scientific revolution took place in India under colonial hegemonisation? (iii) to understand the developmental discourse of industry and specifically the pharmaceutical industry in colonial India? and finally (iv) how the socio-economic and socio-political perspectives cumulatively lead to the emergence of pharmaceutical industries in India? In brief, the present paper attempts to understand the developmental discourse of indigenous pharmaceuticals in colonial India under the shadow of scientific impetus, colonial hegemonisation and economic nationalism. The study reveals that socio-historical and socio-political contexts ultimately led to the emergence of 'indigenous pharmaceutical industry' in the convergence of colonial industrialization, economic nationalism and modern cultures of consumption.

Key Words : Alchemy, Chemistry, Pharmaceutical, Industries, Colonial India

Introduction

In 1908, British Prime Minister Arthur James Balfour in Henry Sidgwick Memorial Lecture declared

‘ science is the great instrument of social change, all the greater because its object is not change, but knowledge, and its silent appropriation of this dominant function, amid the dim of political and religious strife, is the most vital of all the revolutions which have marked the development of modern civilization’ .

Science as a rational exercise is intrinsic to human nature. The vast and imposing structure of modern science is perhaps the greatest triumph of the human mind. But the story of its origin, its development and its achievements is one of the least known parts of history¹. Historians deal with war, politics, economics etc., but the growth of these activities which have opened our vision, revolutionized our philosophic thought and help us to advance our material welfare to a level beyond, most of them tell us little nothing.

To the Greeks, science was nothing but a philosophy². But in the middle ages both were bound up with theology. The experimental method of studying nature thus developed after Renaissance.³ But evolutionary biology, modern mathematics and physics thus deepened the scientific thought, which in turn forced the philosophers to take account of science and thus more meaningful for philosophy, theology and religion too. For this reason, philosophers ultimately came to see that the methods and results of science are the best available evidence and also provide a new realism for the gradual development and progress of the society⁴. In other words, from the dawn of early civilization, man's quest for nature not only enhanced his scientific aptitude but also helps to make scientific foot steps towards greater and greater approximation of truth⁵. Thus there is nothing wrong to label science as a catalytic agent for social development. Therefore, science-society relationship must be understood to articulate this developmental discourse of science and emergence of industry in a comprehensive manner.

Relations of Science and Society

The relationship of science and society are fully reciprocal. Just as transformations are produced inside science by social events, so, and in increasing measure, have social transformations been brought about through the effect of science⁶. Thus science has both direct and indirect effect on the material framework of society by which it is sustained and transformed. The direct effects of the material changes are the easiest to see. They are obvious in continuing and ever accelerating stream of new techniques and improvements of old techniques in the modern world which is inconceivable without science. On the other hand, indirect effects brought about by science are far more important and deep rooted. Basically, science itself was a product of economic and political factors. When science was established as a means of securing economic and political power, as a consequence its progress became a factor in socio-political life.⁷

But one thing should be mentioned here is that material mode is not the only means by which science make it strong steps on society for its development. Science as an endeavour or as a rational treatise have made a profound influence on all other forms of human civilization ranging from philosophy to political to religion even to art and aesthetics.⁸ These influences are much more complete than material plane. Therefore, it cannot be an over statement that the full understanding of the ever changing relations of science and

society involves taking into account both the material and the ideological factors.⁹ Now it is our endeavor to understand the role of science for industrial revolution.

Role of Science for Industrial Revolution

It has long been a general notion that the rise of modern science and the Industrial Revolution were closely connected. Just as advances in technology significantly influenced the Industrial Revolution, the development of the scientific ideas in turn influenced technology and made major contributions to the first and second industrial revolutions.¹⁰ Indeed until the advent of the scientific era, technological advances were almost exclusively based on craft and trade skills and experience, personified by the apprentice model where the skills were handed on very much on a personal and individualistic level. The secrets of the craft or trade were zealously guarded and often shrouded in mystery. It is difficult to show any direct effect of scientific discoveries upon the rise of the textile or even the metallurgical industry in Great Britain, the home of the Industrial Revolution. But there was certainly a similarity in attitude to be found in science and nascent industry.¹¹ Close observation and careful generalization leading to practical utilization were characteristic of both industrialists and experimentalists alike in the 18th century.¹² One point of direct contact is known, namely James Watt's interest in the efficiency of the Newcomen steam engine, an interest that grew from his work as a scientific-instrument maker and that led to his development of the separate condenser that made the steam engine an effective industrial power source. But in general the Industrial Revolution proceeded without much direct scientific help. Yet the potential influence of science was to prove the fundamental importance¹³. What science offered in the 18th century was the hope that careful observation and experimentation might improve industrial production significantly. In some areas, it did. The potter Josiah Wedgwood built his successful business on the basis of careful study of clays and glazes and by the invention of instruments like the pyrometer which gauged and controlled the processes he employed.¹⁴ It was not, however, until the second half of the 19th century that science was able to provide truly significant help to industry. It was then that the science of metallurgy permitted the tailoring of alloy steels to industrial specifications, that the science of chemistry permitted the creation of new substances, like the aniline dyes, of fundamental industrial importance, and that electricity and magnetism were harnessed in the electric dynamo and motor.¹⁵ Until that period science probably profited more from industry than the other way round. It was the steam engine that led the way of a search for a theory of steam power, to the creation of thermodynamics. Most importantly, as industry required ever more complicated and intricate machineries, the machine tool industry developed to provide it and, in the process, made possible the construction of ever more delicate and refined instruments for science. As science turned from the everyday world to the worlds of atoms and molecules, electric currents and magnetic fields, microbes and viruses and nebulae and galaxies, instruments increasingly provided

the sole contact with phenomena.¹⁶ A large refracting telescope driven by intricate clockwork to observe nebulae was as much a product of 19th century heavy industry as were the steam locomotive and the steamship. The Industrial Revolution had one further important effect on the development of modern science. The prospect of applying science to the problems of industry served to stimulate public support for science.¹⁷ The first great scientific school of the modern world, the Ecole Polytechnique in Paris, was founded in 1794 to put the results of science in the service of France. The founding of scores more technical schools in the 19th and 20th centuries encouraged the widespread diffusion of scientific knowledge and provided further opportunity for scientific advance¹⁸. Governments, in varying degrees and at different rates, began supporting science even more directly, by making financial grants to scientists, by founding research institutes and by bestowing honours and official posts on great scientists. By the end of the 19th century the natural philosopher following his private interests had given way to the professional scientist with a public role.¹⁹

Therefore, it is evident from the above discussion that, whatever form of science, a particular society possessed, must be in conjunction with philosophy and religion. Because, the multidimensionality of these conjunction have broadened not only our vision but also created a new vista for societal upliftment which was revealed in different walks of life either in Renaissance or in the industrial revolution.

Keeping this backdrop in mind, the aim of the present endeavour is to understand the history and development of pharmaceutical industry in colonial India. Here the development of 'pharmaceutical' industries is an illuminating lens which enables the present researcher to understand the interaction and interrelation between Indian traditions of thought and western science and the subsequent development of the pharmaceutical industries during colonial period in the Indian subcontinent. Therefore, the present work aims (i) to understand the nature of development of pharmaceutical industries in the West (ii) What kind of scientific revolution took place in India under colonial hegemonisation? (iii) to understand the developmental discourse of industry and specifically the pharmaceutical industry in colonial India and finally (iv) how the socio-economic and socio-political perspectives cumulatively lead to the emergence of pharmaceutical industries in India? In brief, the present paper attempts to understand the developmental discourse of indigenous pharmaceuticals in colonial India under the shadow of scientific impetus, colonial hegemonisation and economic nationalism.

Orienting Science in the West: Context of Pharmaceutical Industries

The above backdrop is in essence the development of Science in different walks of life. Now, let me concentrate upon the development of pharmaceutical industry as a special branch of chemistry. Modern pharmaceutical science is inherently multi-disciplinary. Apart from synthetic organic Chemistry, it is based on pharmacology, physiology, immunology, and bacteriology and fermentation science, among other life science disciplines. While,

scientists and institutions from various countries contributed to the development of these new fields of enquiry, the modern pharmaceutical industry was invented in late 19th century Germany²⁰. Bayer and Hoechst were the most prominent pioneering firms.

The application of synthetic chemistry to drug discovery began to bear fruit from the late 19th century. The dyestuff firms were at the forefront, along with a small number of longer-established pharmacy firms. Arguably, Bayer became the world's first pharmaceutical company in 1888. It placed in the market an anti-pyretic drug which was sold as Phenactin. For the first time, a drug had been conceived, developed, tested, and marketed, all by a private company. It marked the creation of the modern drug industry, the marriage of science and business that has transformed this century, making huge profits even as it saves lives²¹.

By the outbreak of the First World War, Bayer and other German Firms had developed a range of pharmaceutical products based on advance research carried out in-house and in universities and hospitals. For example, in 1874 at St. Mary's Hospital in London, a therapeutic compound developed by a team led by Frederick Pierce turned out to be 'one of the first drugs ever produced by modifying a natural molecule'²². Two decades later, Bayer adopted this new chemical under the brand name 'Heroin'. But most famous drug produced in these early years of the pharmaceutical industry was Bayer's Aspirin.

Another hugely significant advance around the turn of the century was Salvarsan. This arsenical compound, synthesized by Paul Ehrlich, was discovered by him and his colleagues, was effective against Syphilis, and patented in 1909 by Hoechst. Advances in bacteriology and immunology associated with Pasteur, Koch and Ehrlich also catalyzed the emergence of the modern pharmaceutical industry.

By the mid 1960s, it was becoming apparent that the balance of industrial power was shifting from the chemical - pharmaceutical giants like Bayer, Hoechst, Du Pont and ICI to those firms whose background were related more closely to biological Sciences²³.

Case of Germany

The first- ever pharmaceutical products were developed in-house or by chemists based in German Universities and licensed to companies, most of which were primarily dyestuff firms. There are several reasons. Firstly, there was good reason to believe that the research strategies they had adopted and the mass production capabilities they had acquired could be harnessed to drug discovery. Secondly, the same equipment they used for dyestuff production could also be used for drug production. Thirdly, they soon realized that pharmaceutical compounds could be developed from analogous or even raw materials²⁴. Fourthly, as their dyes became increasingly profitable, large funds became available to plough back into research and development. In short, since pharmaceutical research and development could be carried out with the same research strategies, technologies and equipment ²⁵ drug developments was a commercially attractive and feasible proposition. Even before the turn of the 20th century, Hoechst, Bayer, AGFA and the main Swiss dyestuff

firms were producing pharmaceuticals. The main German Chemical companies merged in 1925 to form I.G. Farben industry, which immediately became a dominant player in various types of chemical product, including pharmaceuticals. At the end of the Second World War, I.G. Farben was broken up and Bayer and Hoechst revived as separate companies. For most of the second half of the century, both were among the world's biggest pharmaceutical companies.

Case of Switzerland

The Swiss pharmaceutical industry, like its German counterpart, benefited from early advances in synthetic chemistry. Three of the four most successful companies during the 20th century Sandoz, Ciba and Geigy- began as dyestuff manufacturers. In 1895, Sandoz was the first of these companies to graduate to pharmaceuticals, when it began producing Antipyrin, originally developed by Hoechst. In 1917, the company established a pharmaceutical research laboratory. Five years after Sandoz, Ciba moved into pharmaceuticals, developing two products, Vioform (an antiseptic) and Salen (for rheumatism). Geigy set up pharmaceutical research department in 1938 and eleven years later marketed its first major drug, an anti-rheumatic called Butazolidin. Other important drugs that came out of the Geigy labs after the Second World War included Tofranil (a psychotropic drug), Hygroton (for high blood pressure) and Tegretol (for epilepsy)²⁶.

Case of United States

The German and Swiss firms were the most successful companies up to mid 1930s but from the Second World War onwards, the US industry began to dominate. The impetus for early growth of the US pharmaceutical industry came from such factors as the growing population, availability of chemists and medical scientists trained in American and German Universities and the close links between university scientists and companies.

When the First World War ended, 4767 chemical patents, which included drugs such as Novocain and Salvarsan were sold to the chemical foundation, the US chemical sector for only US\$ 266400 and this was then licensed to companies. For example, Sterling drug was transformed by its acquisition of Bayer's US properties including Aspirin. It was not until the Second World War that the US pharmaceutical industry became committed to any great extent to in-house research and development²⁷.

Case of Britain

The British pharmaceutical industry in the pre-First World War era consisted of rather conservative small and medium sized family firms. Most of those companies extracted drug ingredients from imported plants and minerals for wholesalers, pharmacists and physicians. Some of them also prepared their own proprietary remedies from these ingredients. These companies were originally retailers, e.g., Boots and Allen and Hanburys.

Other firms like May and Bakin began as manufacturing chemists before becoming retailers.

The British pharmaceutical industries continued to consist during the inter war period of small and medium sized firms that were solely producers of drugs. In contrast, the chemical industry of the time in the United Kingdom (UK) and Germany was undergoing a radical consolidation phase that resulted in the creation of two very large firms— Imperial Chemical Industries (ICI) and I.G. Farben.²⁸

Therefore, the industry's progress was steady but not remarkable. But in the late 1930s May and Baker, by that time owned by the French firm Rhone – Poulenc, became one of the British pharmaceutical companies to develop an internationally important new product, M & B 693. From the end of the Second World War the British pharmaceutical industry began to take off.

Scientific Revolution in India under the Shadow of Colonialism

Looking at the development of science through the centuries, we see an accumulating body of knowledge, to which India has made its own contributions by her own methods of investigation. Centuries ago Said-al-Andalusi (1029-70) in his *Tabaqat-al-Uman* referred India as the first nation that cultivated the science²⁹. In the same vein, it can also be said that India is a fertile, even unique ground for an exploration of the historical relationship between religion and science. Especially, in the last one hundred fifty years, when modern science made inroads into colonial India, there has been a vibrant interaction between the two domains.

The scientific revolution in the West was the result of various developments in Europe. The expansion of Europe from the 15th century onwards witnessed the voyage of discovery, the growth of Puritanism and Capitalism; the Post-Renaissance intellectual curiosity to understand natural phenomena and explain this in rational terms. When this was introduced by the British in India it was a derived and dependant system without roots and traditions. It borrowed ideas, models and even the language medium from the West.³⁰

Modern science was introduced in India under the shadow of colonialism. This neither means that its progress in India was simply a matter of European discovery and imperial dissemination, nor that there was no 'science' in India prior to the British conquest of India. However, what is important to understand is that between modern science and traditional science there was a marked disjunction as there was between traditional knowledge and 'English' education'. Moreover, the trajectories of these two are neither co-extensive or co-terminus. In this context, the conjunction between these two, i.e., 'colonial science' and 'national science' need to be explained in a comprehensive manner. 'Colonial Science' has been defined by George Basalla as the absence of scientific tradition in the colonized country³¹.

On the other hand Prof. Chittobrata Palit explained it...

‘Colonial Science is accumulation of scientific knowledge about the resources of the colony and utilization of this knowledge for extraction of these resources for colonial purpose’³².

In this regard, it should also be mentioned that to establish his opinion more rigidly, Basalla proposed a three-staged linear evolutionary framework to explain the spread of western Science in non-European areas³³.

Stage I – Non- Scientific society provides a source for European Science

Stage II – Termed as Colonial Science

Stage III – Completes the process of transplantation with a struggle to achieve an independent scientific tradition or culture.

Basalla tried to explain a complex phenomenon occurring in different culture areas at different point of time in a single linear scheme. In course of time this diffusionist model was vehemently criticized. Basalla’s model was criticized on the grounds that it overly simplified and even romanticized the historical situation.

In case of India, Rajesh Kochhar and Zaheer Baber have both suggested that –

science was introduced fundamentally as a tool for establishing and strengthening British imperial power in the subcontinent. This in turn, according to Kochhar, led to Indians participating in a peripheral sense in British scientific activity. Finally, Indians responded to European science by initiating their own independent scientific activities.³⁴

For Deepak Kumar –

The introduction of western science in India already possessed of an ancient scientific tradition began as a ‘cultural collision’. From this emerged, at the end of the nineteenth century, an independent, native scientific culture that was prompted in large part by nationalistic self-pride and which sought recognition at home and abroad on the merits of its own achievements³⁵.

Yet, in the early stage, the colonial scientist had more freedom and flexibility. There were tremendous difficulties but also enormous opportunities to discover and sight new things. To a large extent, colonial scientists were the masters of their agenda. In this regard, it should be mentioned here that, the state involvement made colonial science more utility-oriented. The colonial science was basically the use of science and technology for exploration of natural resources and extraction of the same for export to the country of the colonial rulers.

However, at the initial stage, though the colonial scientists dominated the activities of the national scientists, later on, within the set up of colonial territory, the national scientists still carried out their nationalist endeavors. There are several instances when original work was done by the national scientists under the most trying circumstances and was widely recognized. No doubt, in science, India’s ancient tradition and multi- dimensional western science co-mingled in turn made national science more objective³⁶.

At this juncture, social reformers in India realized that the indigenous science must

develop as a national endeavor whose reflection can be manifested with the establishment of 'Indian Association For the Cultivation of Science' (1876), 'The Dawn Society' (1902), 'National Council of Education' (1906) etc. This indigenous scientific mentality provided impetus to the indigenous enterprises from the then socio-political environment.³⁷

Though the Indians were under the shackles of British rule, they were instilled by two main ideals - *Boycott of British goods and Atma-shakti or self reliance*. These two ideals influenced the Indians to rise against the British rule. Lack of indigenous industrial goods, lack of the use of indigenous medicines in turn reduced the scope of employment for the youth. In this respect, the Partition of Bengal in 1905 was a bold step. But it must be borne in mind that though in the sphere of science, India had its own glory, it could not have flourished if selective assimilation did not take place with colonial science. The Bengali intelligentsia also were inspired to take up business and industry with a new objective which developed as a reflection of the Industrial Revolution of the West. In this context, Prafulla Chandra. Ray's 'Bengal Chemical and Pharmaceutical Works Limited' can be taken as a 'selective assimilation' of colonial impact or describing it as a derivative discourse of science-colonialism and national entrepreneurship.³⁸

In brief, it can be said that colonial science did help to shift the focus from science as a vocation to science as an enterprise. Miles away from the master-slave dialectics, the post-colonial debates pricked for subsumed contradictions, disjunctions and ambivalences. Models though currently in fashion, are of limited value for analyzing such a complex discourse.

Development of Industry in India

In Europe, industry and scientific pursuits go hand in hand— one helping the other³⁹. In fact, industry has as a rule, preceded science, though based upon empirical knowledge. Soap-making, glass- making, dyeing with purple, scarlet and mineral pigments, metallurgical operations, have been known for the last 2000 years or more, long before the chemical reactions involved in them were understood. The history of the gigantic progress of industry achieved in Europe and America is a history of the triumph of researches in the laboratory. In Bengal the establishment of Technological Institutes or making of a businessman or an entrepreneur or a captain of the industry⁴⁰ were not so much needed at the initial stage.

The first European industrial complex in India, consisting of a cotton mill, an oil mill and a paper mill were established in 1817 at Fort Gloster, 15 miles up from Calcutta on the bank of the river Ganges. The Assam Tea Company came under the control of the British in 1839. It was the first private concern to operate a tea plantation in Assam.⁴¹ The Raniganj Colliery financed in 1820 by Alexander & Co, formed the nucleus of the Bengal Coal Company, one of the pioneer units of the Indian coal mining industry⁴². The first Cotton mill in western India, a spinning mill at Broach, was floated by James Landon in 1854

(followed by the first Bombay Cotton mill set by Cowasjee Nanabhoy Davar in the same year). The earliest jute mill near Calcutta was set up by George Acland in 1855⁴³. All these were small beginnings.

Until First World War, there was no import duty which could possibly offer any sort of protection to any of the Indian industries. Amiya Bagchi has noted this as, "quite contrary to the trend in the rest of the world, including the British Dominions."⁴⁴

The Imperial Government that ruled India was in trouble during the war. The nationalists steadily increased pressure over the Government for more political and economic benefit. Among the benefits that they expected was more measures towards industrialization. India at that time was poor mainly due to breakdown of her small- scale and artisan based industries. These took place during 19th Century. Hence, among other popular demands, industrialization was given top priority⁴⁵.

Government of India decided to set up industrial Commission in 1916⁴⁶, areas to be looked after were the causes of deindustrialization, problems of Capital, industrial training, procuring raw materials and marketing of products. The commission also suggested the ways for industrialization. The noted Geologist, and former Director of Geological Survey of India Prof T. Holland was appointed as the Chairman of the Commission, R. D. Bell acted as Secretary⁴⁷. The industrialists took active interest in the commission work. Holland Commission sent questionnaires to industrialists, educationists, scientists, traders, mining experts, reputed individuals and requested them to meet the commission. The interviews took place in major Indian cities for two years. Besides, written submissions, most of them answered the oral questions put before them by the members of the Commission. Most of them complained about difficulties in capital raising, poor infrastructure, insufficient government support. But they also spoke of immense possibilities of Indian industries, because of easy availability of raw materials and man power. In spite of several constraints, the process of the development of industry started in India⁴⁸.

However, after the First World War, due to the change in socio-political and economic circumstances the government was forced to abandon the policy of *laissez faire*. As a consequence of this measure, industrialization was stimulated to a certain degree. But it could not encourage the new chemical, engineering and metallurgical industries for which fresh markets, sophisticated technologies and a whole range of infrastructural facilities were needed. The narrow technical base of the industrial sector ruled out a pace of industrialization faster than what the country enjoyed after the First World War. Until the basic industries (steel and heavy chemicals) were developed there was no question of initiating more specialized engineering and chemical industries. However, the outbreak of the Second World War brought an unique opportunity to speed up the plans of Indian businessmen for establishing new industries. But the government was against the fulfillment of their aspirations. But after independence, gradually the government took proper initiative for establishing business and industries with new endeavour⁴⁹.

Development of Chemical Industries in India

In relevance to our research, the present discourse will discuss first about the development of chemical industries and then specific emphasis will be given on the development of the pharmaceutical industries in India in a comprehensive manner.

The manufacture of chemicals which started as an art and later developed into an exact science was organized into what the modern world terms an 'industry' only towards the end of the 18th century in Europe, and later in the 19th century, in America. Now, in the 20th century comes the turn of Asia, where the application of technological processes in the manufacture of chemicals and chemical products has increased. This process was initiated first in Japan, and then in India, China and Pakistan, with help and assistance, both technical and financial, from the industrially advanced countries in the West.⁵⁰

However, the oldest and most important source of information about the advance of knowledge of chemistry during this time is *Kautilya's Arthashastra*, a treatise on the management of public affairs. Chemistry in ancient India, however, developed largely as handmade medicine. *Charaka Samhita* also recommends chemical knowledge for its therapeutic significance. But the Indian alchemy remained prisoned at the hands of tantric cult from 700 to 1300 A.D. Although Chemistry in ancient India was never free from religious associations and influences⁵¹.

However, modern Chemical science was introduced in India by the Europeans, especially the English merchants since 17th century. The chemical technologies used by the Indians at that time were classical in nature and new innovations were practically absent. While the European's alchemy gradually faded away at the beginning of the 18th century and the pneumatic chemistry flourished. In spite of official indifference and even discouragement, savants like Jagadish Chandra Bose, Prafulla Chandra Ray helped to revive the dormant scientific spirit. Many other young scholars also devoted themselves into this endeavour. It was in such circumstances that the modern Indian Chemical Industry was born.

The East India Company set up a Chemist Shop in Calcutta in the year 1811 named 'The Bathgate Company'. This company was run by Robinson and Williamson. The first regular Chemical factory in India was established by a British citizen, David Waldie. Mr. Waldie was essentially a man of science and came to India in the middle of the last century after having attained considerable success in chemical research in Britain. He became first acquainted with impure chloroform called aprie ether which had been introduced as an internal medicine in 1833 (Later in 1947, it was used in anaesthetic purpose.) After that, in 1858, Cossipore Chemical Works was established at Cossipore, Bengal, by Dr. David Waldie. Next in the line of pioneers was Butto Kristo Paul & Company which was established in the year 1855. But one who commands our undivided respect and admiration for his services to the modern chemical industry in India was Acharya Prafulla Chandra Ray, called the father of modern Indian Chemistry. In 1891 he established Bengal Chemical and Pharmaceutical Works.

In other parts of India, development of chemical industry was also progressing. Prof. T.K. Gajjar, A.S. Kotibhaskar and B.D. Amin were pioneers in the chemical field in western India and were responsible for the establishment of Alembic Chemical Works in Baroda in the year 1907. Prof. Gajjar founded the Techno Chemical Laboratory in Bombay. Kotibhaskar and Amin together first started in 1903, a small factory at Parel, Bombay where they manufactured pharmaceuticals, toilet preparations and other chemicals based on the use of alcohol. In 1935, there were 23 large chemical factories which increased to 38 by 1939. The most important development in this field was the establishment of a large scale alkali factory at Mithapur in western India by Kapilram Vakil, which in 1939 was taken by J R D Tata. Chemical Industry had made impressive progress in the states of Mysore and Baroda during this period. In 1935 Bombay followed Bengal with the concentration of chemical factories. By 1939, Baroda claimed the second place. In 1938, the Indian Chemical Manufacturers' Association was established. On 6th July 1938, Dr.P.C. Ray became its first president. On the eve of the Second World War, the Indian Chemical Industry presented a stable picture. In 1939, there were 23 Sulphuric Acid factories and the productions of chemicals were steadily rising⁵².

To sum up, it may be said that when the Second World War began, Indian Chemical Industry in spite of all the growth and development, it presented only a microscopic minority of the national industrial potential. But it was not remarkable in comparison to the state of Chemical industry in more advanced countries. The capacity for further growth and expansion was not wanted but it needed a major international catastrophe like the Second World War to neutralize the factors which restricted development and open up a new era of rapid progress.

Development of Pharmaceutical Industries in India

Within chemical industry, the fine chemical industry is closely linked with the pharmaceutical industry. The term 'Pharmaceutical Industry' connotes that sector of the drug industry in India which supports the practice of the allopathic system of medicine. The allopathic system is essentially an import by the British. For their colonial purpose, the British set up a teaching institution at Calcutta in 1835 to train medical practitioners. The pharmacopoeias and *Materia Medica*s of those days contained mainly galenicals and inorganic chemical preparations. The raw materials like Cinchona bark, Nux Vomica seeds, Poppy pods etc. were shipped from India to England and returned as extracts or tinctures for the Physicians' use. At the turn of the century, in 1901, Acharya Prafulla Chandra Ray with great foresight and pioneering spirit started the first Indian owned drug factory, the 'Bengal Chemical & Pharmaceutical Works' on the outskirts of Calcutta.

By this time, Louis Pasteur (1822-1895) had identified pathogenic bacteria as the cause of many infectious diseases and showed the possibility of prophylaxis through immunization. Soon many eminent British medical scientists came to India to study tropical infectious

diseases which were taking quite a toll of their armies. The early state enterprises in Pharmaceuticals were established by them. Haffkine Institute at Bombay (1904), King Institute of Preventive Medicine at Madras (1904), Pasteur Institute at Coonoor (1907) and the Central Research Institute at Kasauli (1905) were the legacy to this nation.

By World War I, the foundations of Chemotherapy or use of chemicals in treatment of diseases had been laid by Paul Ehrlich. The active ingredients of some of the crude plant extracts, viz, alkaloids, were identified. The organic chemists had started synthesizing the active constituents and studying their action. Aspirin, Acetanilide, Barbitol and Adrenaline came into use. But up to 1939, that is the beginning of World War II, England kept this nation as its exclusive preserve for unloading the products of its drug industry. Most of the British manufacturers (for example, Smith, Stanistreet & Co., Calcutta, Bathgate & Co., Calcutta, R. Scott Thomson & Co., Calcutta, Frank Ross & Co., Calcutta, Kemp & Co. Limited, Bombay, W.E. Smith & Co. Limited, Madras, Allen & Co. at Lucknow, Neal & Co. at Delhi etc.) opened branches in India or marketed their products through British training companies established here. However, the following section will cover some of the prominent Indian Pharmacies which operated during the colonial period.

Indian Concerns

Calcutta Companies

Butto Krishna Paul & Co.

Butto Krishna Paul, the founder of this Company, started business in the year 1855⁵³. Initially, the business started at Bara Bazar at Calcutta. Later, the Company moved at Bonfield's Lane, Calcutta. The Company had enormous trade in drugs, chemicals and allied articles. After Buttokrishna's demise, the Company continued with increasing success by his son Bhut Nath Paul. After sometime, cooperation was also received from his brother Hari Sankar Paul and Hari Mohan Paul. In 1927, Hari Shankar Paul made business trip to England. During colonial period, the Company was considered to be the biggest drug store not only in India but also in Asia⁵⁴.

Bengal Chemical & Pharmaceutical Works Limited

At the turn of the century, in 1891, Acharya Prafulla Chandra Ray with great foresight and pioneering spirit started the first Indian owned pharmaceutical industry, the Bengal Chemical & Pharmaceutical Works on the outskirts of Calcutta. Gradually it became the leading pharmaceutical industry in India.

Bombay Companies

S Brothers, I G Gajjar & Co., Bill & Co. were the prominent popular pharmacies among the druggists' firms of Bombay⁵⁵. S Brothers was one of the oldest dispensing Chemists' firm of Bombay. Sorabji Rustomji Pochkhanawala founded the business in 1893. After Sorabji's death, the Company changed management a number of times. From 1948, Sorab

F Ranji and Noshir M Nallaseth conducted the business. After them, the Company was purchased by Chaitanbhai and Pravinbhai Bhupatri Thakkar who continued the business successfully.

Another important firm was I G Gajjar which started in the year 1905. The Company had a dispensing division along with wholesale and import business. Now the Company has owned by R I Gajjar and his son who conducted the supply of pharmaceuticals and also diversified into non-pharmaceutical business.

Bill & Co. made a beginning in 1932. It was founded by Jalbhai Billimoria. The Popular Pharmacy was another firm of Bombay⁵⁶.

Madras Companies

Dadha & Co., Appah & Co. and Wilfred Pereira Limited were the three important firms of Madras⁵⁷. Lakshmichand, Sobhagmall and Lalchand, the Dadha Brothers, started Dadha & Co. in the year 1914. By 1920, the firm emerged as one of the leading retailers of drugs in Madras. The business expanded a great deal. During forties and fifties, the Company opened branches in Hyderabad, Bombay, Bangalore and Cochin. By 1939, the Company stopped the wholesale distribution.

The Appah & Co. started business as Chemists and Druggists in 1928⁵⁸. The two brothers K Alavandar Naidu and K Venkata Pathi Naidu built up a prosperous business during that period. The business expanded. The business flourished and Appah & Co. became a household name for medicines.

Wilfred Pereira, the founder of Pereira Limited, started the Company in the year 1922. It made a remarkable progress and occupied an important position among Chemists and Druggists. Besides running drugs and dispensary departments, the Company also engaged in drug manufacturing. By 1964, the Company started manufacturing on their own.

Delhi Companies

Hemchandra Sen & Co., Young Friends & Co. and Dr.Sahib Singh & Sons were the three oldest druggists of Delhi. Dr. Hem Chandra Sen was a medical officer. After resigning from his job, he started working as a Consultant from 1880. He set up dispensing pharmacy and started manufacturing of galenicals and certain Patent medicines. In 1883, Dr. Sen established the Imperial Medical Hall near Fountain in Chandni Chowk, Delhi. After the demise of Dr. Sen, his son Rash Behari Sen took over the management. The Company became one of the leading dispensing Chemists in Delhi. Rash Behari Sen considered his retail shop as a means to serve the cause of welfare of the people. He was known as doyen of retail pharmacy in Delhi⁵⁹.

Another important firm at Delhi was the Young Friends & Co. The Company was established in the year 1924. Ratan Lal Gupta was a partner of the firm. He actively started working in 1939 after his masters in Chemistry. After 1953, he opened his own firm Ratan

Lal & Co. he was active in Chemists and Druggists organization. He became a leading figure of pharmacy and was nominated to the first Pharmacy Council of India⁶⁰.

Dr. Sahib Singh & Sons were another progressive retail pharmacy at New Delhi⁶¹. The firm was started at Simla in 1922. Around 1932, Dr. Sahib Singh and his younger son Shamsher Singh opened the firm at Connaught Place, New Delhi. The Company made it a success and was held in high esteem. After Saheb Singh's death, his son expanded the business in different parts of the country at Calcutta, Bombay, Madras and Kanpur. After his demise, the Company gradually declined⁶².

The general scarcity of imported medicaments during the years of war gave rise to a number of small manufacturing units producing distilled water, normal saline and such essential simple preparations. A few other forms started tableting and making formulations, which found a ready market⁶³. So from this backdrop, it has been revealed that the Pharmaceutical Industry, though it had its birth in India in the first decade of the present century, was at its infant stage at the time of World War II. Progress was painfully slow. Before the war, India depended almost totally on imports valued at about rupees five crores a year. The war stimulated the demand further. The indigenous industry could supply annually only Rs. 26 lakhs worth of medical stores needed by the Director General of Medical Service at the beginning of the war. Realizing the seriousness of the situation, particularly in the context of war effort, the government of India set up a Medical Store and Supply Committee and two directorates of drugs - dressings - surgical instruments and appliances. These bodies were charged with the task of building up indigenous sources of supply as rapidly as possible without letting political considerations interfere with the implementation of the plans. This bold and imaginative policy paid ample dividends within a short period of time.

Thus in 1939, India was able to produce only thirteen per cent of a very restricted medical vocabulary. By 1943, this country manufactured seventy per cent of a very much expanded list. Between the formation of the directorates and the end of the war, rupees one hundred six crores worth of drugs, dressings, surgical instruments, hospital glass ware and porcelain ware, appliances, hygiene chemicals and packing materials were locally procured after successful results of analytical and quality tests. Large quantities of alkaloids such as - morphine, caffeine, atropine etc. were produced during the war. India was able to supply large quantities of Cod Liver Oil to Europe to help the rehabilitation of war victims.

India of course, had for long been drawing her requirements of galenicals from indigenous sources and had no difficulty in meeting the expanded demand during the war. The same however could be said with regard to synthetic drugs, the want of suitable equipment being the main obstacle in this field. The visit of Grady Mission to India resulted in some equipment being obtained from USA and a number of items of this group were produced by indigenous manufacturers.

According to 1948 Census of Industries, the Pharmaceutical Industry took the third position on the value of the products and by-products of the entire chemical industry. The Indian Pharmaceutical Industry showed a keen interest in the manufacture of proprietary drugs during the Post war period. By 1951, most of the requirements were coughs medicine, antacid products, and tonics.

The Drugs Act (1940) and Drug Rules (1945) were the main pieces of legislation enforced by the Union and state government. The responsibility was to regulate the manufacturing process of pharmaceutical products to ensure proper purity and quality of drugs, their proper storage and distribution by experienced and qualified persons and to prevent adulteration.

Socio-economic and Socio-political Perspectives of the Development of Pharmaceuticals in Colonial India

The East India Company established its supremacy in the year 1757. The beginning of the modern factory system thus can be placed in the 1850s⁶⁴. More specifically, the year 1858, when the crown took over the administration of India and ruled over India lasted ninety years from 1858 to 1947⁶⁵. The introduction of 'entrepreneurship' can be placed in this juncture. Though the term 'entrepreneurship' is a complex phenomenon which is difficult to encompass in a single definition. It should be kept in mind that the introduction of entrepreneurship in a country mostly depend upon the social and economic environment, capacity for vision and an ability to undertake risk bearing capacity over a long period. Therefore, in Indian context, if anyone tries to understand the emergence of entrepreneurship in the colonial era, he should know the structural features of India's economy of that particular period. For a better understanding, it can be grouped into three broad headings – (a) structural features, include the overwhelming importance of natural resources and labour to economic growth, (b) global features, focus on the fact that India's economy was more open and had strong global ties at that time and (c) colonial features, like large remittance paid by the government to Britain⁶⁶. However, the structural features of India's economy changed slowly specifically after independence (drastic reduction in the influence of global factors on the domestic economy).

Before the establishment of industry in India or even before the colonial period, agriculture had been the predominant sector for India's economy. But constant high risk, possibility of migrating to cities and to other British colonies made occupational choice more diverse. In such a socio-economic and socio-political context, Indian intelligentsia took over business for economic self-sufficiency even under the colonial domain. Basically, colonial exploitation, patriotic mentality and overall economic nationalism lead them towards private entrepreneurship as a means of self-sufficiency in livelihood under the shadow of colonial empire. But Indian's workforce was not significantly prone to industry as of today. In 1901, about fourteen million industrial workers formed only about eleven per cent of the total workforce⁶⁷. So in such a circumstance industrialization began in India. In describing

industrialization in colonial India, it is necessary to begin with a distinction between 'traditional' and 'modern' industry. Thus 'traditional' industry include handloom textiles, leather manufactures, metals utensils, pottery, food processing, wood work etc. On the other hand 'modern' industry includes cotton and jute mills. Thus it can be said that the modern industry was essentially a product of India's contact with Britain. Factory employment in the colonial period was overwhelmingly dominated by the textile industry-mills for cotton and jute industries, wool and silk spinning and weaving industries. Mention may also be made like paper, sugar, matches, cement and steel. Technology and capital goods were imported for running these factories. However, these modern factories were concentrated in two provinces, such as Calcutta and Bombay due to their positions as major centers of transportation. But in spite of that in 1850s and onwards India's capital markets were inadequate to channeling household savings to industrial investment. Because investment in industry means taking a great risk and machinery, migration, urbanization everything were new ingredients so far as the investment in industry is concerned.

The early colonial period between 1858 and 1914 saw positive economic growth for India. India's real national income grew at over one percent between 1868 and 1914. These growth rates appeared to be rising late in the nineteenth and in the early 20th century. By contrast, the interwar period of the 1920s and 1930s was a difficult time not only for India or Britain but also for the world economy.⁶⁸ So, the above mentioned comprehensive backdrop of India's economy during colonial period has described the beginning of industrialization and private entrepreneurship in colonial India and the nature of economic condition subsequently. Now it will be the present researcher's endeavour to look at the emergence of 'pharmaceutical industry' in the confluence of colonial industrialization, economic nationalism and modern cultures of consumption.

The emergence of 'pharmaceutical industry' in the late 19th Century colonial India was one of foreign domination like other modern industries⁶⁹. On introduction of the new medical system in India, emergence of Pharmacy houses were necessary to meet the requirements for the western drugs and other medical supplies. In the British Empire, India was a place for doing lucrative business. European Chemists and Druggists also found this location promising for practicing their profession. Europeans were attracted because, the population was large enough to provide good returns. By 1880, the population of Calcutta was around one million⁷⁰. The European population was probably equal to that of other Indian cities combined. The British population was mostly concentrated in these locations. The Civil and Military Services' personnel and their families and the rich native gentry constituted the main clientele. The common people could not afford to pay the European prices⁷¹. Along with Pharmacy, the European Chemists and Druggists also added other profitable lines to their business⁷². These were manufacturing of aerated water, photographic apparatus, surgical instruments, hospital furnishings, toilet requisites, wines and liquors etc. The European establishments engaged Chemists' assistants (who were brought from Britain)

who constituted the moral fibre of the business^{73,74,75} In this way, Chemists' assistants made success in their professional career in India. In the places outside the cities the Chemists' businesses were adjuncts to general stores. Other than Europeans, the rich Indians also patronized the European Pharmacies but the prices at these outlets were beyond the reach of common people⁷⁶.

Basically, the development of pharmaceutical industries in India was a cumulative effect of self-sufficiency in natural or indigenous resources, historical trajectory that refers back to Indian nationalism and emergence of scientific professionals as a product of western education. Beside these factors there are other two reasons which acted as a major catalytic agent for the establishment of pharmaceutical industries in colonial India. These were – (i) establishment of medical institution for western medical education and introduction of new western health care system, (ii) a great rise in urban consumerism around the time between 1900-1901.

In other words, the major thrust for establishment of pharmaceutical industries in India was (i) to revive the mentality of the Indian intelligentsia into trade or business for economic self-sufficiency, (ii) to strengthen Indian medical system and (iii) to fulfill the demand of the urban population vis-à-vis creating a domestic pharmaceutical market even in colonial era.

To sum up, it can be said that overall three major historical processes basically led to the emergence of indigenous pharmaceutical industries in colonial India. These were –

- (i) Industrialization and economic self-sufficiency by Indian nationalists gained momentum due to the expansion of capitalism in the country.
- (ii) Encouragement of Indian industrialization by the colonial state power specially in products like steel, cotton, chemicals and drugs and patronization of Indian industries during the inter war period led to the development of pharmaceutical industries.
- (iii) The domestic demand for pharmaceutical products which were enhanced by the emergent urban middle class led to the growth of such industries in the Indian subcontinent⁷⁷.

Therefore, it can be said that the emergence of indigenous pharmaceutical industries and its success in colonial India again reveal the interconnectivity between science and society and its direct bearing on material development of the society.

Conclusion

In conclusion it can be said that, science and technology of pharmaceutical research and development have transformed over the last hundred years. Today's pharmaceutical industry is dominated by transnational corporations almost entirely from USA and western Europe, especially UK, Switzerland and Germany. In India too, several multinational pharmaceutical companies have made their emergence. As a consequence, indigenous pharmaceutical companies are facing tough competition for their survival. In India, the discourse of

development of pharmaceutical industries not only portrays political and economic background to the emergence of the indigenous pharmaceuticals in colonial India but links economic nationalism and the quest for self-sufficiency among Indian nationalists and entrepreneurs. The development of the pharmaceutical industry in India can be symbolized as a specific wave of cultural response to modern science which was to pave the subsequent trajectory to national scientific endeavour in India. In spite of several other constraints, indigenous pharmaceutical companies are still striving to maintain their name, fame and sound footing even in the era of globalization.

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