

SHANTI SWARUP BHATNAGAR

A
Science Czar

S.P.K. GUPTA

Shanti Swarup Bhatnagar will always be remembered as a great institution builder, a scientist and a visionary.

PROF. SHANTI SWARUP BHATNAGAR had a distinguished career at Lahore's University Chemical Laboratories in December 1939.

Arcot Ramaswamy Mudaliar had a few months earlier taken over as Member, Commerce and Labour in the Viceroy's Executive Council, and Industry was in his portfolio. And almost the first decision he was to take was on a proposal that would diminish his charge. The economy drive instituted on the outbreak of the war in Europe called for the abolition of the Industrial Intelligence and Research Bureau at Calcutta.

The Bureau was a grudging British concession made in July 1934 to the native demand for promotion of industrial development. With a measly annual budget of one lakh rupees and an advisory council chaired and dominated by bureaucrats of the Indian Stores Department, it did little more than overseeing the National Test House, which was just a quality control unit, and a small adjunct laboratory.

Its 1937-38 report had been lambasted as "a miserable document" at the Lahore session of the Indian Science Congress by J.C. Ghosh who in his presidential address placed the blame for this not on its personnel but on the step motherly Government. The eminent scientist demanded a national planning committee to formulate industrial schemes and an All India Council of Scientific and Industrial Research with representation, as in UK's DSIR, for university scientists and industrialists.

There was no coordination of official scientific agencies after the closure of the Government's Board of Scientific Advice in 1924 as an austerity measure during the post-war recession. And the recommendation of the 1926 Imperial Conference in London of a Council of Industrial and Scientific Research was vetoed on grounds of "financial difficulties".

The initiative two years later by C V Raman and J C Ghosh for an Advisory Board of Scientific Research was strengthened when Richard Gregory, editor of *Nature*, toured the science departments of Indian universities and told



Samuel Hoare, Secretary of State for India, that such a board was necessary to use "the undoubted capacity of Indians for scientific investigations and its applications" for developing the country's resources. Hoare advised Viceroy Willingdon to

draw on "wealthy Indians" for the support of an Indian "DSIR" but Willingdon torpedoed the idea. As a sop to scientific opinion, the Indian Industrial Intelligence and Research Bureau was established.

The inadequacy of the Bureau served to keep the Board idea alive, and the idea received a boost from the renowned British scientist, Ernest Rutherford, who in an address read posthumously at the 1938 Indian Science Congress said only a truly national research organisation responsible to the federal government would be of service to India. James Jeans, who as successor president of the British Association for the Advancement of Science read Rutherford's address, toured India lecturing at universities and stimulating the scientific community.

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Bhatnagar lacked either enthusiasm for or expectation of government intervention, and proposed a private enterprise-cum-university initiative in December 1938. Speaking at the National Institute of Science in Bombay, he asked industry to shed its apathy and have a research organisation of its own, harnessing the services of university college professors and their excellently equipped laboratories.

In concrete terms, Bhatnagar proposed an all-India industrial research council of university professors and captains of industry to evolve an industrial development programme. And he asked the government to help with subsidies, protective tariffs, loans and promotion of "mergers" of enterprises to end "cut-throat" competition.

J C Ghosh on the other hand underlined at the 1939 Indian Science Congress the British DSIR model espoused by Rutherford for India, and asked for a national committee to formulate comprehensive industrial development schemes and an all-India CSIR with proper representation for university scientists and industrialists.

Bhatnagar fell in line and shortly after the Science Congress spoke at the Lahore branch of the Indian Chemical Society commending an Indian DSIR in terms that would appeal to the three constituencies—the British government, the industry and the university scientist. He said narrow provincialism was disastrous to science and technology and even an all-India out-look would not be satisfactory. A commonwealth based on a united interest in the expansion of industries should be a greater cementing force than a British Empire with territorial limits, he said.

Arcot Ramaswamy Mudaliar had made up his mind and recommended abolition of the Industrial Intelligence and Research Bureau: "The old Bureau should be abolished not as a measure of economy but to make room for a Board of Scientific and Industrial Research with more resources and wider objectives." He argued: "In war time, no economy can be too disastrous which starves industrial research and no expenditure can be too high which mobilises the scientific and industrial talents of the country for research

and production of war materials."

Mudaliar's argument convinced the Viceroy. He agreed in principle to an advisory board of four or five prominent industrialists and three or four scientists of eminence with the Commerce Member as chairman. The board would have the specific function of investigating the effect of war on India's development, of initiating as well as considering outside proposals, investigating what is commercially desirable from the scientific and technical standpoint, and examining what is scientifically worthy in the light of commercial possibility. The Viceroy was for a scientist member of the board to be its executive, a whole time government servant designated 'Director of Industrial Development' and with a monthly salary of Rs. 2500, to work out schemes, pursue investigations, arrange research on schemes and formulate projects.

And Linlithgow wanted Bhatnagar to be that director. During a visit to Lahore two years earlier, he had been impressed by Bhatnagar's work at the University Chemical Laboratory. It was he who sent Mudaliar to Lahore with the offer.

For Bhatnagar it was an opportunity to create an organisation he was vainly pleading with industry to set up, an organisation his scientific colleagues had been asking the government to create, an organisation that would extend an activity in which he had been involved in the previous few years on a relatively modest scale.

Bhatnagar was concerned that many young graduates in science were unemployed or worked on petty jobs with meagre salaries. Once in the mid-30s he advertised the post of a laboratory assistant and even PhDs applied. He told Mahendranath Sahai: "It breaks my heart to see the state of unemployment among the highly educated, not to speak of the lesser educated." Mahendranath said: "Doctor Saheb, why don't you create a number of laboratories on the pattern of your UCL?" to which Bhatnagar replied: "You have taken the words out of my mouth."

The viceregal offer brought by Mudaliar would see the realisation of his dream of industrialisation of India and of



employment of India's scientific talent. Bhatnagar went to Delhi for an interview.

Mian Afzal Husain, vice-chancellor of the Punjab University, was dismayed at the prospect of losing the Doctor Saheb who was an institution in Lahore and lent prestige to the university. Linlithgow had to write to Henry Craik, governor: "I feel justified in appealing to you to let us have a man who is certainly, I should judge, one of the foremost scientists in this country and who would be most admirably qualified to help us in an issue of real significance." He hoped that Craik would help him secure Bhatnagar's loan to the Government of India for two years. The CSIR scheme was still experimental and the post was sanctioned for only two years: Bhatnagar should continue to have a lien on his appointment with the university.

Craik knew the University Chemical Laboratory had attracted students from all parts of India and its achievements had won recognition in Europe. He had publicly lauded Bhatnagar's decisive successes in research of both practical and academic importance and in applying science to the fullest and most profitable use by industry of the province's natural resources. He had, in speeches, referred to the commercial value of Bhatnagar's work and the large sums of money English firms had placed at his disposal for investigations. He had also spoken of the fundamental character of

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his studies on the magnetic properties of atoms and molecules in order to unravel the nature of chemical reactions. Hence his reluctance to let Bhatnagar go.

But a viceregal appeal was a governor's command. Craik wrote Linlithgow that he shared his high opinion of Bhatnagar's capacity and attainments and the value of the work he had been doing in Lahore. He in fact considered Bhatnagar the most distinguished figure at the university and would be sorry to see him leave the Punjab. He however appreciated the importance of the appointment for which the Viceroy required him and would not raise any obstacle.

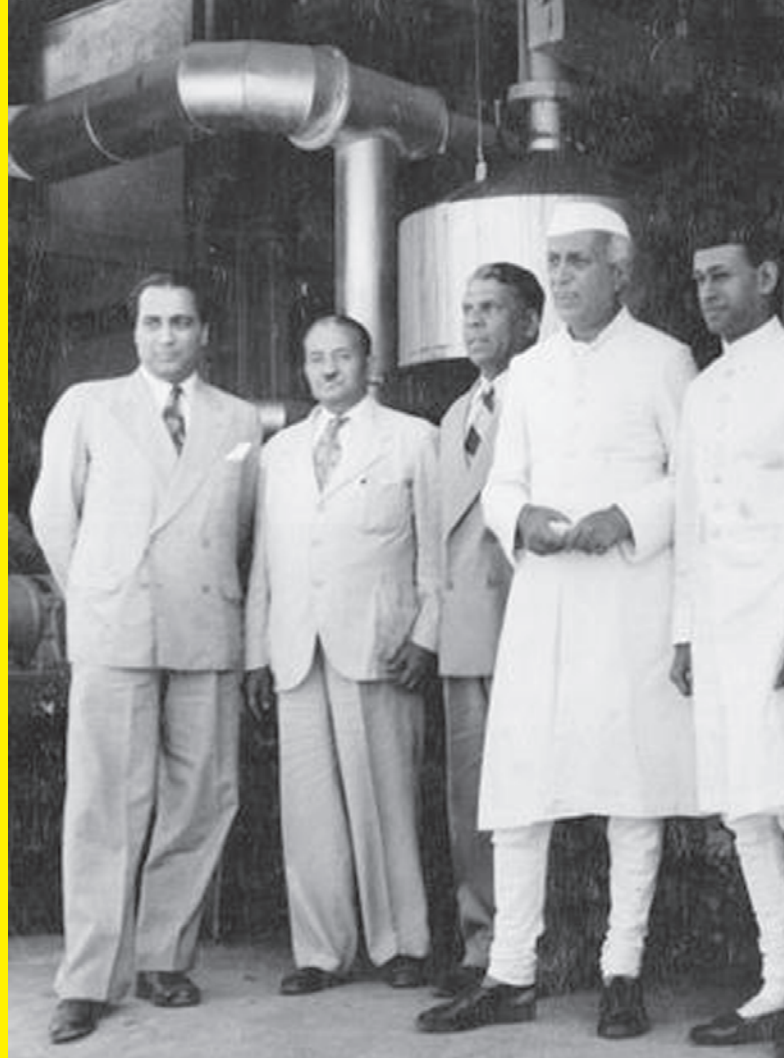
Craik at the same time cautioned Linlithgow: Bhatnagar was an industrial chemist of exceptional capacity and his research in oils, textiles and other materials was of great commercial value. It was fine if in his new employment he would either carry on research personally or supervise research by others. Bhatnagar however had not had any experience organising a government department or carry on the routine of such a department.

Linlithgow made sure Bhatnagar was allowed his desire to have a research laboratory of his own and to bring with him the six Steel Research Scholars at the University Chemical Laboratories, and that his official position was designated Director of Scientific and Industrial Research.

Once it got reconciled to his departure, Lahore feted and feasted Bhatnagar in farewell. The night he left for Delhi, the Lahore station platform was crowded with his research workers and staff in full force as well such notables as Justice Bakshi Tek Chand, Vice-chancellor Afzal Husain, Raja Narendranath and Professor Ruchi Ram Sahni. The Frontier Mail steamed out bearing Bhatnagar almost smothered in garlands.

The Board of Industrial and Scientific Research met for the first time on the evening of Monday the 1st of April 1940 in the Commerce Member's room in the Assembly Chambers (later Parliament House) with Mudaliar in the chair. All the members – scientists Jagadish Chandra Bose, Nazir Ahmed, Meghnad Saha, Bhatnagar, civilians H P Mody and Syed Sultan Ahmed, and industrialists Kasturbhai Lalbhai, Lala Shri Ram, P F G Warren and N N Law – were present as also the Secretary

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of the Commerce Department and the Economic Adviser to the Government of India.

Mudaliar outlined the functions of the Board as advice to the Government on research, help to institutions in scientific study of problems of industries and trades, and research studentships, scholarships and fellowships based on proposals from research institutions, universities, industries and trades as well as Board members. The Board had an annual budget of five lakh rupees inclusive of one lakh rupees for administration.

Bhatnagar's headquarters were to be in Calcutta where he could use the Government Test House Laboratory. There was no laboratory in Delhi that suited his purpose. Until he moved with his family to Calcutta on 20 June, he stayed in Simla, the summer capital of the government, working out a programme of research for the development of war industries.

While he was in Simla, the Board held there its second meeting. Bhatnagar's small Calcutta lab couldn't possibly handle the whole gamut of war-related research

that was planned out. The Board decided on research committees with such eminent scientists as C V Raman, M N Saha, S K Mitra and J C Ghosh to evaluate proposals from collaborating universities and research institutions and monitor execution of those that were finally approved by a body of government officials.

By the yearend were engaged some 80 researchers including 20 directly employed by BSIR. The war provided the stimulus but a mere four lakh rupees had to be shared by 16 committees which met once a year to review and report on vegetable, oils, fertilizers, drugs, plastics, sulphur, scientific instruments, graphite carbon and electrodes, molasses, glass and refractories, vegetable dyes, fuel and cellulose.

The laboratory in Alipore adopted by Bhatnagar was the main centre of war-related industrial research. The Steel Researchers left their commodious laboratories in Lahore in August and got down to their work here – and produced results. Here they made a varnish to make the seams of the gas mask (for which they



had already a process of anti-gas fabric) impervious to gas; and hit upon wire mesh for the windows as glass imports from America were blocked. Soon American supply of the translucent air-impervious coating for the wire-mesh came to an end, and they succeeded in developing a coating solution with indigenous material. There was then a wire mesh shortage, and they hit upon the treatment of a basic fabric to make it translucent, weather proof and waterproof. They sold the patent to Simbhaoli Sugar Mills that set up a subsidiary, Indian Class Substitute Company, to initially manufacture three million square feet of the treated fabric.

Under Bhatnagar's supervision, they made a special lubricating oil for bronze bearings and Steel Brothers gave the formula free to the North Western Railway, a petroleum preservative for timber, a substitute for china wood oil by dehydrating castor oil.

Many academic centres including universities previously inactive in industrial research for lack of funds were now stimulated by BSIR's scheme of grants;

particularly the Banaras Hindu University and the University of the Punjab.

Bhatnagar travelled a lot, visiting; every part of India, inspecting, advising and coordinating. He wrote in newspapers, broadcast over All India Radio, addressed scientists and industrialists on his cooperative plan for scientific and industrial research with a bearing on the war needs but fundamentally for establishing for India a place in world industry from which it could not be displaced after the war.

BSIR's own scientists and research workers in cooperating institutions worked out in 1941 processes for purifying Baluch sulphur, making fuels and lubricants with blended vegetable oils, emulsifying pyrethrum, packing books and ammunition in plastic cases, army uniform dyes and vitamins.

Some research results were beyond utilization during the war but capable of adoption by the industry nevertheless. To take care of this, the government set up an Industrial Research Utilization Committee composed of 15 industry figures and Bhatnagar, who held their first meeting in Delhi on 12 February 1941.

The royalties went into a fund that was ploughed back into research. The Central Assembly voted in November 1941 a motion by Mudaliar for an Industrial Research Fund with an annual grant of ten lakh rupees for five years. The Fund's administration was entrusted to the Council of Scientific and Industrial Research (CSIR) registered in September 1942 as a society.

The Council would promote scientific and industrial research by helping establish institutions, laboratories and workshops, instituting studentships and fellowships, and disseminating research and industrial information through scientific papers and a Journal of Industrial Research and Development. It would also help exploit discoveries and inventions of use to industries.

This reorganisation and the subsequent increase of the annual budget to Rs. 15 lakh did not serve to conceal altogether the poor status of the Indian industry, the half-hearted role of the state in revamping it to meet wartime needs and inadequate support of science to these efforts. While Britain's DSIR and Australia's CSIR had found the war a blessing in disguise, funds and men assigned to India's CSIR showed that it had

When the governing body of CSIR held its second meeting on 18 July 1942 at Bombay, it had before it an offer by Tatas to build and equip a National Chemical Laboratory. In pursuance of its decision to co-opt donors of rupees five lakh and more, it inducted J.R.D. Tata. It also scrutinised tentative plans for not only NCL but also a physical laboratory, a fuel research station and a metallurgical laboratory.

only a marginal part in the war effort. This part would appear to be even more insignificant in the light of the astronomical funds spent by Canada, Germany and the United States on scientific and industrial research during the war.

In spite of these limitations and constraints, Bhatnagar managed to see that Indian science made a creditable contribution to the war effort. He was able to expand the team he brought from Lahore by offering scholarships.

Bhatnagar's laboratory in collaboration with Lac Research Institute and other laboratories developed successful processes for production of plastics from indigenous resources. Jettison tanks and petrol-proof plastic containers were prepared out of jute and shellac; building materials were fabricated from bagasse plastics; fibre board, containers, identity discs and insulating material were made from jute and shellac; plastics for electrical appliances from horn waste; and enamels, lacquers and varnishes out of bilhawan or marking nut.

Then there was a Japanese bombing raid on Calcutta and Bhatnagar was asked to move to Delhi to be available for consultation. He moved his headquarters as well as the research groups to Delhi in January 1942. The physics and chemistry blocks were getting ready for the University of Delhi in the old Viceregal Lodge campus, and Bhatnagar took over them to set up his laboratories.

Bhatnagar wanted new uses for oilseeds whose overseas markets had been cut off, and guided his team in developing processes for making lubricants and motor fuel from vegetable

Indian Postal Stamp released to honour Dr Shant Swarup Bhatnagar during CSIR Golden Jubilee Celebration



Stamp Issue Date: 21/02/1994

Stamp Denomination: 1.00

Stamp Language: English

Stamp's Color: Multicolour



“Sir Shanti is also the inventor of a widely used stove hardly larger than a matchbox, which gives off intense heat for twelve hours from a single filling of solid fuel. He has produced fabrics and other materials resistant to poison gases and cotton cloth with the insulating properties and the warmth of wool.”

When he took over the BSIR, Bhatnagar began to receive a stream of letters from would-be manufacturers eager to cash in on the war—from those who could invest a few rupees and from those whose ambitions ran into thousands of rupees. Occasionally he met the great industrialists who had tasted the fruits of big business and knew that small capital will not be able to reap large benefits.

The war had developed with such rapidity that it offered little scope for those who wished to start de novo. It could largely benefit only those enterprises that were already manufacturing and ready to expand and adjust to the rapidly changing conditions.

All the same, to meet the most urgent requirements of the war, new plants were set up to manufacture chlorine and bleaching powder, nitric acid from synthetic ammonia and, at Tatanagar, benzene and toluene from coal. Tatas were also helped to manufacture surgical steel. When a cottage industry sprang up in South India and Ceylon specialising in inactivated charcoal from coconut shell, for gas masks, Bhatnagar wanted the widely dispersed units to be knit into a chain of systematic organisation.

Bhatnagar called the attention of investors to subsidiary industries that could be developed from raw materials – oilseeds, bones, skins and leather wastes – whose disposal had become a serious problem with the closure of export avenues. The success of BSIR-financed research on utilisation of jute, grass, oilcake, mo’ asses, spent tans and other industrial wastes, on extraction of plant products, particularly the active principles of ayurvedic drugs could lead to the establishment of new industries.

Asserting the scientist’s belief that the then ongoing strife was but the birth pangs of a new and better civilisation, Bhatnagar dwelt on alternative sources of energy that would last thousands of years, artificial foods that would solve the hunger problem, sulphur drugs that would conquer disease and alleviate human misery.

Bhatnagar wrote in an earlier *Hindustan Times* article that the creation of BSIR had caused the universities and the industries alike to become keenly alive to harness scientific knowledge to practical ends through research. He said action must follow what the mind’s eye visualised. The action he himself visualised was a chain of national laboratories created and

oils. Thousands of gallons of lubricants were produced. The process was shared with China.

He could initiate research in drugs and dyes whose imports had been interrupted. Glandular products were extracted from slaughterhouse wastes. Two arsenics – Atoxyl (Sodium Arsanilate) used in syphilis and trypanosomiasis and Carbarsone for amebiasis, pemphigus and vaginitis – were synthesised from easily available raw materials. Pyrethrum cream was prepared for scabies among the armed forces in the South-east Asia theatre; vegetable dyes were extracted from forest wealth.

Some of the processes worked out in collaboration with defence organisations began to be used in operations: The air force got a device for testing high tension ignition cable, varnishes for petrol storage tanks, patching cement for repairing petrol tanks, petrol-proof hose-pipes and containers, petrol pump diaphragms, smoke candles and distress flares, hot food containers and shock-proof packing material made of coconut fibre. Plastic sheets made of jute or canvass cloth with plastic material produced in BISR labs were pressed in moulds for making streamlined American motorcar bodies. It made Bhatnagar proud.

The *New Republic of USA* wrote in its 20 September 20 1943 issue: “Our troops have greatly been aided by the invention of ‘unbreakable containers’ in which even

liquids can be dropped from airplanes upon hard ground without being shattered. These containers are the work of Prof. Shanti Swarup Bhatnagar, director of the recently established All-India Board of Scientific and Industrial Research. Sir Shanti is also the inventor of a widely used stove hardly larger than a matchbox, which gives off intense heat for twelve hours from a single filling of solid fuel. He has produced fabrics and other materials resistant to poison gases and cotton cloth with the insulating properties and the warmth of wool.”

Criticising the U.S. administration for retaining the law barring Indians from American citizenship while not scorning to take advantage of numerous important inventions and discoveries of Indian scientists in India as well as those resident in USA to help win the war, the journal noted: “The proportion of distinguished scientists among educated men in India is exceptionally high, probably because the situation in India under the British rule makes other outstanding careers abnormally difficult. The proportion of scientists among Indians in the United States is still higher. In relation to their total numbers, Indian scientists outnumber British ones here by sixteen to one, French twenty-six to one, Germans thirty-six to one, Spaniards seventy to one.”

Bhatnagar’s bid for science-based industrialisation of India, taking advantage of the wartime opportunities, had important consequences for the country,

By the time he died on 1 January 1955, he had created a chain of twelve laboratories dealing with different disciplines ranging from physics and chemistry to leather and pharmaceuticals.

Sir Shanti Swarup Bhatnagar with Pt. Nehru, the then Prime Minister of India, and Ms Indira Gandhi



directed by BSIR with the help of industry for industry. The response of the industry, particularly by such leaders as Tatas, was encouraging. Bhatnagar also was successful in securing budgetary support of the colonial government caught between wartime pressures and lobbying by British scientists for a post-war commonwealth of science.

The government in creating the Council of Scientific and Industrial Research in 1942 with BSIR and IRUC as its advisory bodies had blessed the idea of special institutions for scientific study of problems affecting particular industries and trades.

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The governing body in July 1943 set up committees to advise on NCL, a glass and silicate institute and a drug testing laboratory, and to explore with the Finance

Department an early inauguration of NPL and NML rather than putting it off, as suggested, till after the war. NCL's capital cost of Rs. 10 lakh had already been contributed by Tatas and Mr Baldev Singh, and Poona was selected as its location. Later that year, it appointed to the NCL committee Dr K Venkataraman, Director of the University of Bombay Technological Laboratories. Tatas then came up with an offer of Rs.11.70 lakh for NML and it was held up as an example for those "interested in the welfare and advancement of industry and research". The Raja of Jharia offered 100 acres of land for the fuel research station, and the Bengal Glass Manufacturers' Association together with two individual donors offered Rs. 30,000 for the glass research institute.

The Finance Department made a grant of Rs. 10 lakh for the fuel station and glass institute, and the planning of other laboratories. Calcutta was chosen as the site for the latter after ceramics was added to its field of research and the Jadavpur College offered a plot of five bighas at one rupee a bigha for 99 years. Dr Atma Ram, secretary of the committee that prepared the report on the glass institute, was appointed officer-in-charge and a Calcutta firm of architects was retained.

Realising that no idea in a bureaucratic setup can have the requisite support without the backing of a committee, Bhatnagar successfully

mooted the appointment of an Industrial Research Planning Committee in 1944. The report of the Committee headed by R K Shanmukham Chetty provided the basis for the establishment of what came to be known as the Bhatnagar Eleven: the physical, chemical, metallurgical, glass and ceramic, fuel, building, road, leather, electrochemical, drug and food technology research laboratories. But a long haul was ahead.

The appointment of Dr Lal C. Verman and Dr S Siddiqui, brother of Chaudhary Khaliqzaman, as acting directors respectively of the physical and chemical laboratories of BSIR at the Delhi University campus served to create the nuclei of the future NPL and NCL. Dr Bashir Ahmed and Dr K N Mathur were the planning officers of the two separately.

In the mean time had arrived in India Prof A V Hill, biological secretary of the Royal Society, to advise on the organisation of scientific research. Hill found BSIR had not yet had the time to have its influence felt in full though it had produced important results. Hill could already see India inching toward self-government but envisaged a common policy of scientific interchange and cooperation in research and practical application of results by countries of what would be the Commonwealth, and subsequent integration of commonwealth science with scientific organisations of the United States and other countries.

The British clearly saw Bhatnagar as an ally in the task of keeping India in the future setup of "Imperial" (later Commonwealth) science. Hill as a matter of fact brought with him a parchment of the Royal Society empowering him to admit Bhatnagar and Homi J Bhabha into Britain's oldest and most exclusive scientific society.



With this end in view, Hill proposed research training of young Indians in the United Kingdom, the establishment of an Indian scientific office in London and scientific liaison with the United States and the "Dominions".

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Departing for the first time from the tradition of admitting new Fellows at a formal meeting of the Royal Society where they signed the original Charter Book on which the first signature was affixed by King Charles II in 1662, it permitted a proxy ceremony during the 31st Indian Science Congress held on 3 January 1944 in Delhi. Hill admitted Bhatnagar and Bhabha into the Society and read congratulatory messages from Royal Society President Henry Dale, J C Smuts and Premier Winston Churchill.

After the Science Congress, Hill was Bhatnagar's guest and the opportunity was put to best use for contriving contacts through a swift succession of luncheon and dinner parties to which were invited the high personages of New Delhi's official world and their wives. India appeared to be in the throes of an industrial revolution, thanks to the tremendous impetus received due to pressing war needs, and Bhatnagar was determined to take advantage of it in the cause of science and technology.

A goodwill mission of Indian scientists, of which Bhatnagar was also a part, arrived in London on 11 October 1944. For seven weeks, they visited industries, universities, technical institutes and scientific societies.

At a luncheon by the Indian and Eastern Newspapers Society, Bhatnagar spoke of the complementary needs of Britain and India. Contrary to belief in India, he had found British leaders eager for the success of Indian industry, which was to the interest of industrial Britain. Britain had scientific and industrial skill and experience while India had raw materials for industry. Indians were ready for mutual cooperation, and his Mission was struck by signs of friendly cooperation it had found everywhere in Britain.

At the university centres of Oxford, Cambridge, Manchester, Sheffield and Edinburgh, they saw the work in progress and discussed admission of Indian students for technology and for research and made contacts with scientists and industrialists.

Next it was a veritable triumphal march across the United States for eight weeks. The Mission saw all the leading centres of research and industry. Institutions vied with one another in extending hospitality. The State Department held a reception. Visits to industrial laboratories of the Radio Corporation of America, the Bell Telephones, the General Electric, the Shell Development, the American Cyanamid, the DuPont and the Industrial Solvents were arranged as also to the Massachusetts Institute of Technology at Boston, the Carnegie Institutes at Washington and Pittsburgh, the Mellon Institute, also at Pittsburgh and the California Institute of Technology at Pasadena.

At a CIT dinner, Bhatnagar revealed himself as a man of wit and humour. Among the guests was a doctor who was critical of India and started off the question-and-answer session asking if India had left

any gold without payment of which America wouldn't go to her help? "I and my colleagues," Bhatnagar said, "have just come from England where we were told that all of India's gold as well as Britain's was held in the Washington treasury and that Americans were honest people."

Undeterred the doctor asked whether the guests from the slow and dallying East noticed anything that came late in America. "Old age and all its accompaniments including wisdom," was Bhatnagar's quick reply.

"Well," persisted the not-so-young doctor, "from the wealth of information and wisdom the replies contained I surmise that the Indian scientists were well advanced in years and yet they do not have a grey hair between them. What is the secret of their youthfulness?" Bhatnagar's repartee: "We in India do not spend sleepless nights thinking of blondes!" This brought hearty laughter and cheers from the Americans who knew the cap fitted the questioner.

Bhatnagar's end came not long after his return from the trip. By the time he died on 1 January 1955, he had created a chain of twelve laboratories dealing with different disciplines ranging from physics and chemistry to leather and pharmaceuticals. He also established the National Research development Corporation of India to translate scientific research into industrial products.

Bhatnagar will always be remembered as an institution builder, a scientist and a visionary.

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