THE VISIONARY AND THE VISION

THE VISIONARY AND THE VISION

Based on his conviction that science is an enabler of social transformation, Homi Bhabha worked to transform the lives of the people of India. In the same spirit, this exhibition is dedicated to them for their generous and constant support of fundamental research.

Permanent Exhibition Committee, TIFR

Mustansir Barma, Ananya Dasgupta, Avinash Dhar, Uma Mahadevan, Maithreyi Narasimha, Oindrila Raychaudhuri, Spenta R. Wadia

Archival material for the exhibition

Ananya Dasgupta and Oindrila Raychaudhuri, TIFR Archives

Text

Uma Mahadevan and Spenta R. Wadia

Text adapted from

"Homi Jehangir Bhabha and the Tata Institute of Fundamental Research" by Spenta R. Wadia, Current Science, Vol. 96, March 10, 2009

Additional sources

Bhabha and his Magnificent Obsessions, G. Venkataraman, Universities Press (1994)

Homi Jehangir Bhabha (1909—1966), Lord William Penney, Biographical Memoirs of The Royal Society of London (1967)

Homi Jehangir Bhabha (1909—1966), by Sir John Cockcroft and M.G.K. Menon, The Royal Institution of Great Britain (1967)

Homi Jehangir Bhabha, "Collected Scientific Papers", edited by B.V. Sreekantan, Virendra Singh and B.M. Udgaonkar, Tata Institute of Fundamental Research (1985)

Tata Institute of Fundamental Research (1945—1970), Silver Jubilee Commemoration Volume (1970)

Design

Eureka Moment Design Company

Execution

Turnkey Interior Solutions and Comart

The TIFR Endowment Fund thanks the following for their involvement and support in this project :

Ajay Abhyankar, Chitrak Bandyopadhyay, Indira Chowdhury, CIBRA, S.H. Ghadiali, Swarna Kanti Ghosh, Shankar Iyer, Surendra Kulkarni, Vinod Kumar, Kishore Menon, Shiraz Minwalla, Samadhan G. Narwade, R.A. Patil, Bharati Malar Periasamy, Chandrakant Punde, Sriram Rajput, Sreerup Raychaudhuri, S.J. Sane, Rajesh Sharma, A.A. Shrivardhankar, A.P. Singh, Sangam Sinha, Praveen Suradkar, TIFR Auditorium, TIFR Central Workshop, TIFR Photography, TIFR Security, TIFR Technical Services Group, TIFR Vigilance, J.B. Waghmare, Sanjay Wategaonkar.

Homi Jehangir Bhabha, one of the leading figures of modern science in India, was the founder of the Tata Institute of Fundamental Research and main architect of India's atomic energy programme.

On the occasion of the 100th Birth Centenary of Homi Bhabha on October, 30 2009, a permanent exhibition titled, **'The Visionary and the Vision',** commemorating his life and achievements was inaugurated in the foyer of the Homi Bhabha Auditorium, Tata Institute of Fundamental Research. The exhibition was inaugurated by Dr Anil Kakodkar, Chairman, Atomic Energy Commission and Secretary, Department of Atomic Energy, Government of India.

This exhibition showcases Bhabha's scientific contribution to elementary particles and cosmic ray physics, which were brilliant and have a lasting value, and upon which the edifice of his great achievement rests; his visionary and historic contribution to institution and nation building in which research, education and technology go side by side; it also highlights Bhabha's involvement in the arts and his attempt at a synthesis of the arts and science which is reflected in all his ideas and the institutions he created.

The exhibition has been conceptualized by the TIFR Endowment Fund and is supported by a grant from the Jamsetji Tata Trust. The archival material used for display has been provided by TIFR Archives.

THE VISIONARY AND THE VISION

"A scientific institution, be it a laboratory or academy, has to be grown with great care like a tree… and the few outstanding ones always take at least 10 to 15 years to grow."
– Homi Bhabha

The vision of Homi Jehangir Bhabha, founder of the Tata Institute of Fundamental Research (TIFR) and of India's atomic energy programme, was to develop science in India, and to use its benefits to take the newly independent nation on the path of economic and social development. Nurturing this vision with extraordinary commitment, just as he nurtured the trees and gardens he loved, Bhabha laid deep the roots of scientific research in India.

For Bhabha, meaningful research had no boundaries: "Fundamental research can only be judged by world standard. It is worthwhile only if one adds, in however small a way, to the sum total of human knowledge." Simultaneously, in applied research and technology, he emphasised the need for India to develop indigenous capability and self-confidence.

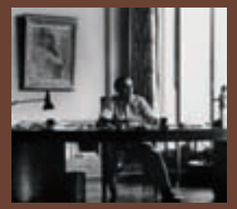
Bhabha's ideal of science was profoundly intertwined with the ideal of a better world. He knew that science had the potential to transform lives. As he said in his lecture at the inauguration of TIFR in 1945:
"The pursuit of science and its practical application are no longer subsidiary social activities today. Science forms the basis of our whole social structure without which life as we know it would be inconceivable. As Marx said, 'Man's power over nature lies at the root of history.'… Science has at last opened up the possibility of freedom for all from long hours of manual drudgery and today we stand at the beginning of an age when every person will have the opportunity to develop himself spiritually to his fullest stature."

It was a thoughtful and deeply humane vision.

THE VISIONARY

HOMI BHABHA
1909 - 1966

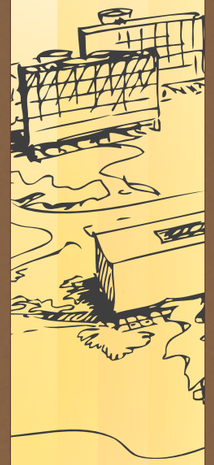
AND THE VISION



"I have for some time past nurtured the idea of founding a first class school of research in the most advanced branches of physics in Bombay.... The scheme I am now submitting to you is but an embryo from which I hope to build up in the course of time a school of physics comparable with the best anywhere."

- from Homi Bhabha's proposal dated March 12, 1944 to the Sir Dorabji Tata Trust

With these words, the idea of the Tata Institute of Fundamental Research was born.



Just four years earlier, while on vacation in India when war broke out in Europe, Bhabha had joined the Indian Institute of Science (IISc), Bangalore, where a Readership in Theoretical Physics was specially created for him. Professor C.V. Raman, who was at IISc at the time, was deeply impressed by his young colleague.

But as Bhabha worked in pre-independent India, he became seriously concerned about the state of research in the country.

In a letter to his close friend J.R.D. Tata in 1943, Bhabha shared his sense of anxiety :

"The lack of proper conditions and intelligent financial support hampers the development of science in India at the pace the talent in the country would warrant."

At J.R.D.'s suggestion, Bhabha wrote to the Sir Dorabji Tata Trust on March 12, 1944 with a proposal for a world-class research institute in India :

"There is at the moment in India no big school of research in the fundamental problems of physics, both theoretical and experimental… It is absolutely in the interest of India to have a vigorous school of research in fundamental physics, for such a school forms the spearhead of research not only in less advanced branches of physics but also in problems of immediate practical application in industry."

Thus it was that despite being involved in the forefront of research, Bhabha decided to devote himself to the activities of growing science and building the nation.

The road ahead was clear : as he wrote to the physicist S. Chandrasekhar at the University of Chicago,

"Provided proper appreciation and financial support are forthcoming, it is the duty of people like us to stay in our own country and build up outstanding schools of research such as some other countries are fortunate to possess."

R.D. Choksi, trustee of the Sir Dorabji Tata Trust, recommended Bhabha's proposal as a pioneering initiative :

"What distinguishes a Trust is not its ability to give or the extent and range of its giving but the character of its giving… this can only be done adequately where from time to time a Trust initiates and fosters new institutions and new types of service to society."

The Trust accepted Bhabha's proposal. The Government of Bombay showed interest in becoming a joint founder.

Meanwhile the new institute began functioning on June 1, 1945 in a lab in IISc, Bangalore, going on to publish eight research papers even before the formal inauguration. Outstanding scientific work always took precedence with Bhabha : buildings could come up later.

On December 19, 1945, TIFR was inaugurated in Bombay. In a memorable inaugural lecture about the state of research in the world, Bhabha also discussed the philosophical aspects of science.

"Ideas are some of the most important things in life," he said, "and men are prepared to suffer and die for them."

Occupying a part of Kenilworth, a Peddar Road bungalow owned by Bhabha's aunt, TIFR was now working from the house in which Bhabha was born. By late 1949, the institute's activities had grown. TIFR moved to a new home : the Old Yacht Club at Gateway of India.

(From left) Raja Ramanna, K. Chandrasekharan, E.C. Allardice, Rustom Choksi and Bhabha during the visit of Nehru to TIFR

(From left) Devendra Lal, B.V. Thosar, B.M. Udgaonkar and Bhabha during the visit of M.C. Chagla to TIFR

B.V. Sreekantan (left) during the visit of John Cockcroft in TIFR

Govind Swarup describing the Ooty Telescope to Anthony Hewish and others

EARLY RESEARCH AREAS AND DEPARTMENTS

"It is our intention to bring together as many outstanding scientists as possible in physics and allied lines so as to build up in time an intellectual atmosphere approaching what we knew in places like Cambridge and Paris,"
- wrote Bhabha to S. Chandrasekhar in 1944.

Attracting the best talent

As brilliant individuals joined TIFR to set up and lead research groups, the institute's departments grew steadily around them. The first research areas to be taken up were theoretical physics, experimental work in cosmic rays and high-energy physics, and mathematics.
For Bhabha, research in modern experimental areas was of critical importance, not only for its own sake and to provide the right balance for the theoretical studies, but also for the consequent confidence that it generated in the design, fabrication and use of equipment. For similar reasons, Bhabha understood the importance of growing mathematics at TIFR. In his speech at the foundation stone laying ceremony of the new campus, he said that *"It is only with the help of mathematics that one can understand today the complicated and subtle phenomena which nature reveals."*

Over the years, activities at TIFR steadily expanded to include nuclear physics, condensed matter physics, computer science, and later molecular biology and radio astronomy.

The early team of scientists at TIFR included :
K. Chandrasekharan, D.D. Kosambi and K.G. Ramanathan (Mathematics), R.R. Daniel, Devendra Lal, M.G.K Menon, Bernard Peters, B.V. Sreekantan (Elementary Particles and Cosmic Rays), R. Narasimhan (Computer Science), K.S. Singhvi (Solid State Physics), B.M. Udgaonkar (Nuclear and Theoretical Physics), A.S. Rao (Electronics), S.S. Dharmatti (Nuclear Magnetic Resonance) and H.L.N. Murthy (Workshop).

One of the first people Bhabha had invited to join TIFR was S. Chandrasekhar of the University of Chicago (although Chandrasekhar did not ultimately join TIFR).

In the School of Physics, promising young researchers were sent to established western institutions like Berkeley, Caltech, Chicago, MIT, Rochester and Stanford for training with eminent scientists. These included S.S. Jha, N. Mukunda, Yash Pal, G. Rajasekaran, Virendra Singh and E.C. George Sudarshan. Several of them returned to TIFR. Sudarshan discovered the famous V-A law of beta decay while still on leave from TIFR.

K. Chandrasekharan trained the mathematicians M.S. Narasimhan and C.S. Seshadri who later went on to be the pillars of the School of Mathematics. Obaid Siddiqi (Molecular Biology) and Govind Swarup (Radio Astronomy) joined in the early-sixties.

TIFR : CRADLE OF INDIA'S ATOMIC ENERGY PROGRAMME

With remarkable foresight, envisioning that India should have its own expertise in the use of atomic energy for development, Bhabha had already planned that the new school would also conduct research in nuclear energy. In his 1944 letter to the Trust, he outlined the reasons why this was a critical area of work for the new institute : *"When nuclear energy has been successfully applied for power production in say a couple of decades from now, India will not have to look abroad for its experts but will find them ready at hand. I do not think that anyone acquainted with scientific development in other countries would deny the need in India for such a school as I propose."*

TIFR thus became the birthplace of the nation's atomic energy programme, and Bhabha its visionary and meticulous architect.

Bhabha and M.G.K. Menon during the visit of U.S. Ambassador J.K. Galbraith to TIFR

Obaid Siddiqi in the molecular biology laboratory at TIFR

Bhabha and R. Narasimhan during the visit of John Cockcroft to TIFR

Bhabha and Bernard Peters during the visit of the Soviet delegation of N. Khrushchev and N. Bulganin to TIFR

Bhabha with Nehru

Discussing the layout of TIFR's Colaba campus.

BHABHA AND NEHRU

Throughout Bhabha's efforts, he had the firm support of Prime Minister Jawaharlal Nehru. Common ideals and aspirations for the young nation had forged a deep bond between the two men. Both were towering figures in their respective fields. To Bhabha, Nehru was his dear "Bhai", and it was his encouragement that Bhabha drew upon repeatedly while building TIFR into an institution of international repute, as well as in the setting up of the Atomic Energy Commission, the Atomic Energy Establishment at Trombay, and the Department of Atomic Energy.

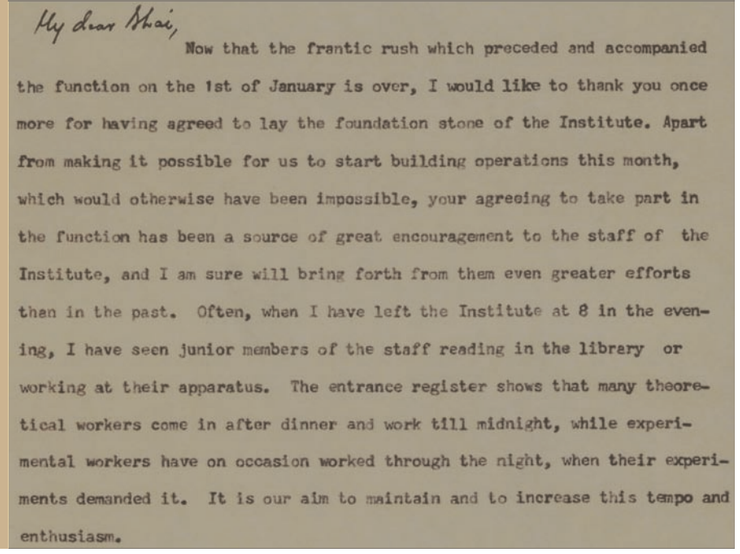
In the early 1950s, as TIFR looked for a permanent home for its rapidly expanding activities, it was Nehru whose personal intervention helped it to acquire 15 acres of land in Colaba from the Ministry of Defence. On January 1, 1954, Nehru laid the foundation stone for the new campus. On January 15, 1962, Nehru inaugurated the new buildings of the TIFR campus.

"For Jawaharlal Nehru the supreme task of the age was to lift mankind from its age-old state of bare subsistence to a social level which provided security, material plenty and above all the opportunities for fulfilment and a higher life to all. He knew that this aim could be achieved through, and only through, science and its application...

He felt, quite rightly, that operating a steel mill or a chemical plant set up by foreign assistance hardly made the country an advanced and industrialised nation, any more than using a car or flying an aeroplane purchased from abroad. It is only when India has acquired the ability to design, fabricate and erect its own plants without foreign assistance that it will have become a truly advanced and industrialised country, and for this a much greater development of science and technology is still necessary. 'We have to produce not only machines that are to be used,' he said, 'We want men who will design machines and improve them.'

Although not a practising scientist, Jawaharlal Nehru's personality revealed throughout the essential attributes of the real man of science - his unquenched thirst for truth, his questing mind that admitted no man-made barriers, his essential humility, his constant willingness to learn and to teach."

-from Homi Bhabha's talk, "Jawaharlal Nehru and Science", broadcast on All India Radio on June 1, 1964.



My Dear Bhai,

Now that the frantic rush which preceded and accompanied the function on the 1st of January is over, I would like to thank you once more for having agreed to lay the foundation stone of the Institute. Apart from making it possible for us to start building operations this month, which would otherwise have been impossible, your agreeing to take part in the function has been a source of great encouragement to the staff of the Institute, and I am sure will bring forth from them even greater efforts than in the past. Often, when I have left the Institute at 8 in the evening, I have seen junior members of the staff reading in the library or working at their apparatus. The entrance register shows that many theoretical workers come in after dinner and work till midnight, while experimental workers have on occasion worked through the night, when their experiments demanded it. It is our aim to maintain and to increase this tempo and enthusiasm.

When Bhabha returned to India, he was already a physicist of international repute. At IISc, he continued at the height of his scientific career.

Yet it was the vision of a modern India at the turn of independence that led this highly accomplished young scientist to devote himself to the task of building great institutions.

Equally, a deep appreciation of beauty underlaid the design of everything that Bhabha built. J.R.D. Tata once described his admiration for his *"sense of natural value, sense of nature and the fact that whatever he built had to be beautiful"*.

Every aspect of TIFR, from its scientific ideals to its carefully laid out gardens, bears testimony to the vision of Homi Bhabha.

How did one man accomplish so much in a single lifetime, excelling in every endeavour he undertook : engaging in pathbreaking scientific research, building great institutions, making policy at the national and international level, and remaining involved with the most important cultural movements of the time? A considerable part of the answer lies in the beginning.

Homi with his father Jehangir Bhabha, mother Meherbai and younger brother Jamshed

THE EARLY YEARS

Homi Bhabha's childhood was spent in progressive and cosmopolitan Bombay. He grew up in a cultured and influential family deeply that was involved in education, art, science, industry and nation-building. This early environment played a key role in shaping his worldview in the years to come.

Homi was born on October 30, 1909 to Jehangir Bhabha, a lawyer trained in England, and Meherbai, granddaughter of philanthropist Sir Dinshaw Petit. He was named after his paternal grandfather, Hormusji Bhabha, Inspector General of Education in Mysore.

Homi's paternal aunt, also Meherbai, was married to Dorab Tata, the elder son of the pioneer of Indian industry Jamsetji Nusserwanji Tata. Here, at the Tatas' ancestral home, the commercial world of his industrialist uncle revealed itself to the young Homi.

But he also observed the deep bonds that the Tatas forged with institutions of learning. Notably, following the death of Jamsetji Tata, Sir Dorab had taken charge of the Indian Institute of Science, Bangalore.

Homi had his schooling at the Cathedral and John Connon School which, he would remark years later, did much to foster his love for science. After attending Elphinstone College and the Royal Institute of Science, both in Bombay, Homi was sent to England in 1927, to the Gonville and Caius College in Cambridge, where Homi's uncle Sir Dorab had also studied and to which he had made a handsome endowment.

With his family wanting him to become an engineer, Homi enrolled for the Mechanical Sciences Tripos.

Homi as a child

The young Bhabha with his family

My dear Hammond,

Thank you for your letter of September 11, 1955, and your congratulations. The Cathedral High School did much to foster a love for science in me. One's school years are often the most formative ones and I remember enjoying my school days very much.

It was nice to hear from you again after such a long time. I hope you are well and are enjoying your retirement.

With my best wishes,

Excerpt of letter from Homi Bhabha to C.H. Hammond, retired Principal of the Cathedral and John Connon School

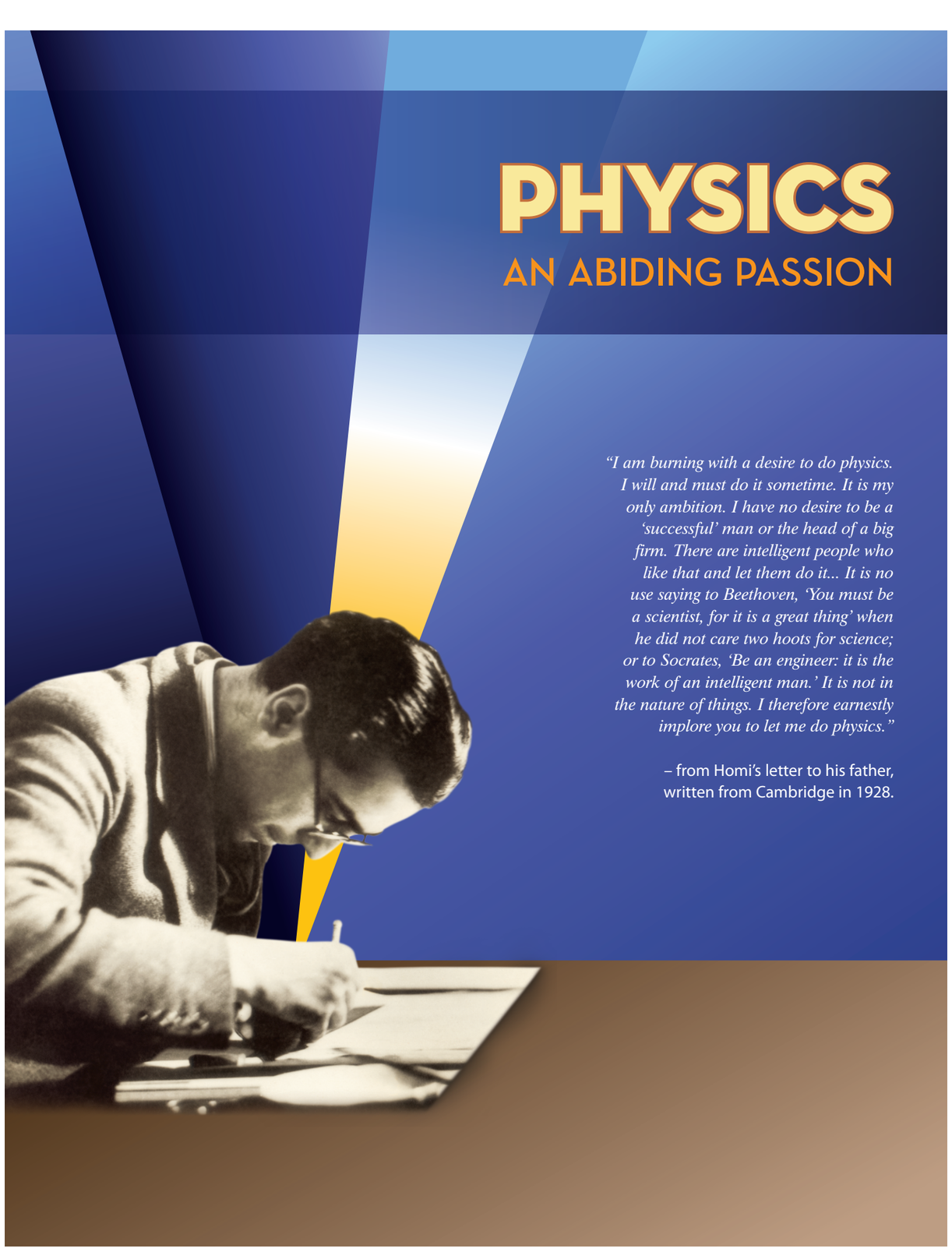
Finding his calling

At Cambridge, Homi's interests soon shifted to theoretical physics and mathematics. He described this passion in a letter to his father in 1928 :

"I seriously say to you that business or a job as an engineer is not the thing for me. It is totally foreign to my nature and radically opposed to my temperament and opinions. Physics is my line. I know I shall do great things here. For, each man can do best and excel in only that thing of which he is passionately fond, in which he believes, as I do, that he has the ability to do it, that he is in fact born and destined to do it...Besides India is not a land where science cannot be carried on."

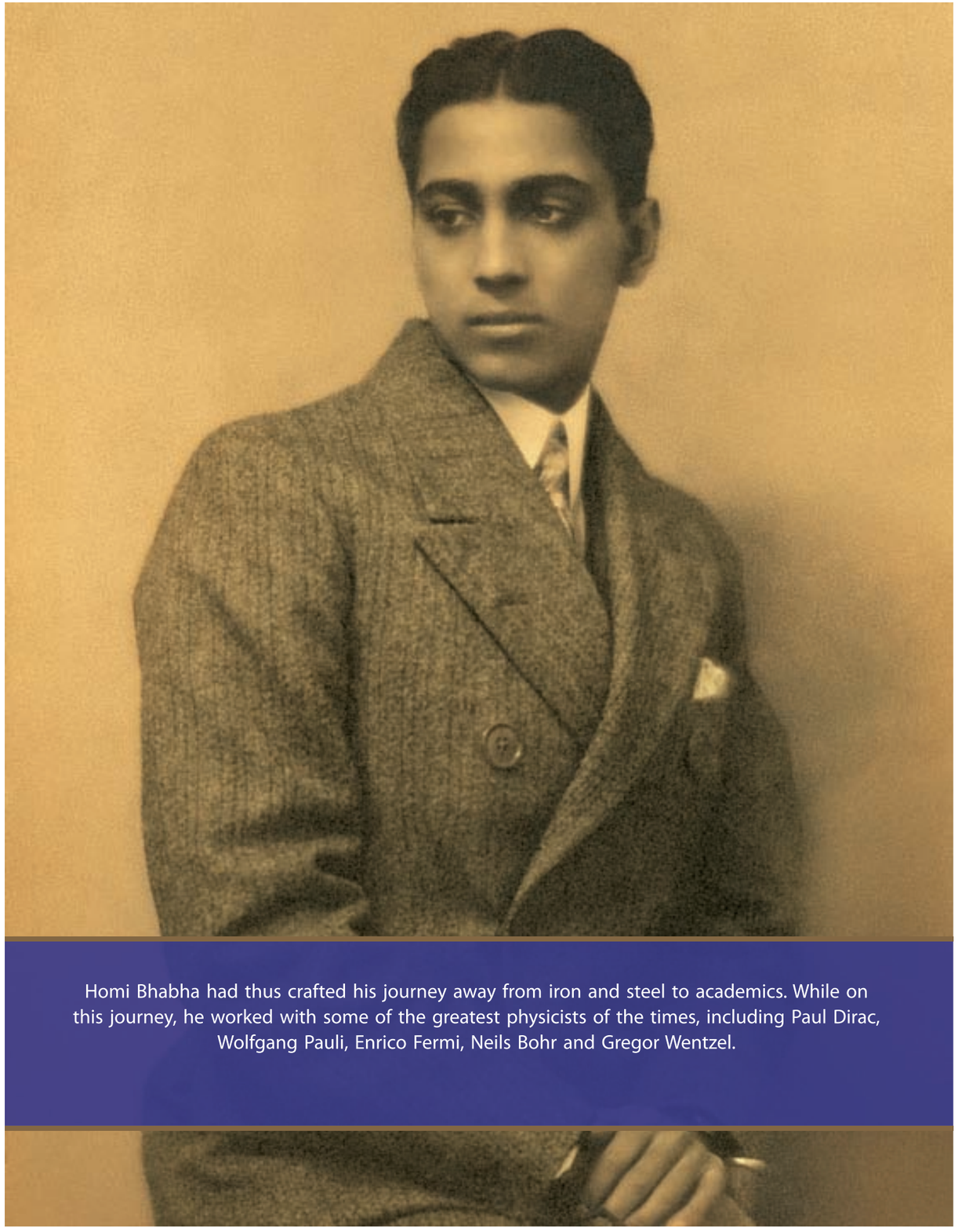
Homi's father agreed to his son's wish to take up the Mathematics Tripos on the condition that he should first complete the Mechanical Tripos. This Homi did; thereafter, he passed the Mathematics Tripos again with first class. He was now free to take up his great passion, which was physics.

PHYSICS
AN ABIDING PASSION



"I am burning with a desire to do physics. I will and must do it sometime. It is my only ambition. I have no desire to be a 'successful' man or the head of a big firm. There are intelligent people who like that and let them do it... It is no use saying to Beethoven, 'You must be a scientist, for it is a great thing' when he did not care two hoots for science; or to Socrates, 'Be an engineer: it is the work of an intelligent man.' It is not in the nature of things. I therefore earnestly implore you to let me do physics."

– from Homi's letter to his father, written from Cambridge in 1928.



Homi Bhabha had thus crafted his journey away from iron and steel to academics. While on this journey, he worked with some of the greatest physicists of the times, including Paul Dirac, Wolfgang Pauli, Enrico Fermi, Neils Bohr and Gregor Wentzel.

THE CAMBRIDGE PERIOD

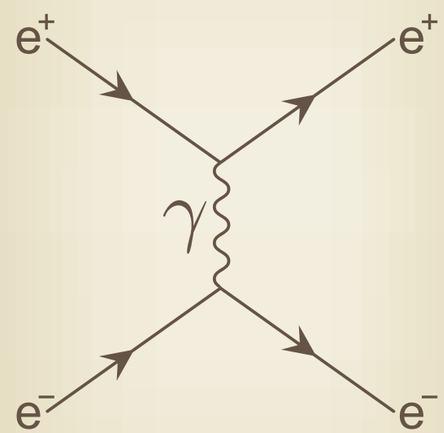
At Cambridge, Bhabha joined the Cavendish Laboratory, from where he obtained his Ph.D with R.H. Fowler as his thesis supervisor.

Bhabha's important contributions during the Cambridge period include the explanation of relativistic exchange scattering (Bhabha Scattering); the theory of production of electron and positron showers in cosmic rays (Bhabha -Heitler theory); speculation about the Yukawa particle related to which was his suggestion of the name meson; and prediction of relativistic time dilatation effects in the decay of the meson.

Bhabha was the first to do a proper quantum theoretic calculation of the process of electron-positron annihilation and creation – one of the basic processes in quantum electro dynamics using Dirac's theory. This process, known as the Bhabha Scattering, is even today used as a luminosity monitor in electron-positron collider physics experiments.

Homi Bhabha and Paul Dirac

Bhabha Scattering



SCIENTIFIC CONTRIBUTIONS

Jointly with the German scientist W. Heitler, then at Cambridge, Bhabha explained the cosmic-ray shower formation in a paper published in 1937. It had been discovered by 1918 that there is a strong level of radiation in the upper atmosphere. Robert Millikan, who was the first to identify that the origin of the radiation was from outside the Earth, called it cosmic radiation.

During the 1930s, it was discovered that extensive but short-lived patches of high-intensity radiation develop in the sky, and then die out. Bhabha and Heitler developed a theory of this process by the cascade production of gamma rays and electron-positron pairs.

A high-energy particle from the Sun, or from some remote source like a star, a galaxy, or a quasar, hits the atoms of the upper atmosphere. This hard hit causes the nuclei of these atoms to disintegrate, creating a number of high-energy fragments and new particles. These fragments fly off with enough energy to hit neighboring atoms and cause their nuclei in turn to disintegrate and fly off.

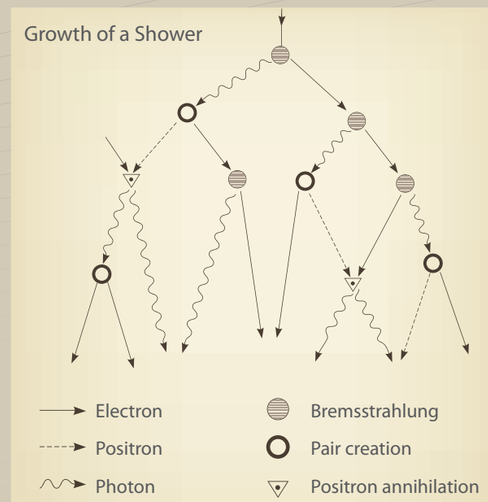
This process continues, over miles, with ever-diminishing energy, till the last fragments in the chain have no more energy to cause nuclear reactions. The shower of fast-moving charged particles thus created gets detected as cosmic radiation.

Not all the experimental facts about cosmic ray showers, however, were accounted for by the Bhabha-Heitler theory. To explain the penetrating component, Bhabha made the far-reaching hypothesis that there must exist a new particle with the same characteristics as the electron but approximately 100 times heavier. Today this particle is called the 'muon'. It is approximately 200 times heavier than the electron.

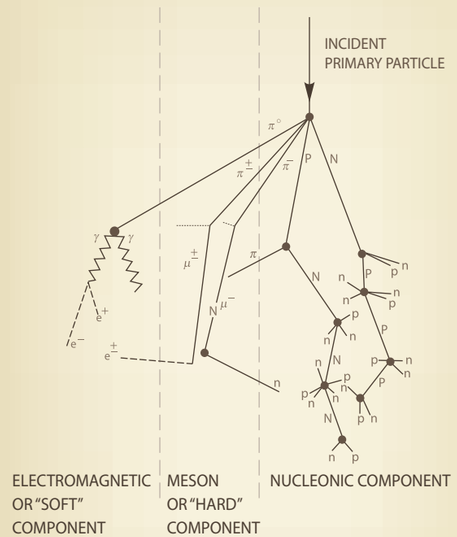
Bhabha was also the first to point out that cosmic rays, moving at speeds close to that of light, are the best place to verify the conclusions of Einstein's Special Theory of Relativity. For example, mesons, which normally decay within a distance of half a kilometer, can travel more than 10 km down to the Earth's surface because relativistic time dilation increases their decay lifetime.

Bhabha proposed vector mesons as particles, in addition to Yukawa's scalar mesons, that would play a role in the nuclear interaction. These vector mesons were massive, had spin one and odd parity. Thus he explained the fact that the triplet state of the deuteron (a heavy isotope of hydrogen whose nucleus has one proton and one neutron) was the lowest stable state.

The Bhabha-Heitler picture of a shower produced by a cascade of electromagnetic processes



Production of secondary cosmic ray particles in terrestrial atmosphere



The Passage of Fast Electrons and the Theory of Cosmic Showers

By H. J. Bhabha, *Gonville and Caius College, Cambridge*
and W. Heitler, *Wills Physical Laboratory, University of Bristol*

(*Communicated by N. F. Mott, F.R. S. — Received 11 December* 1936)

Introduction

It is well known that according to relativistic quantum mechanics, electrons and positrons with energy large compared with their rest mass have a very large probability when passing through the field of a nucleus of losing a large fraction of their energy in one process by emitting radiation. Hard quanta have a correspondingly large probability of creating electron pairs. Until recently it was believed that the direct measurements of Anderson and Neddermeyer on the energy loss of fast electrons showed that though this energy loss by radiation existed, it was much smaller for energies greater than about 10^8 e-volts than that theoretically predicted, and it was therefore assumed that the present quantum mechanics began to fail for energies greater than about this value. More recent experiments by Anderson and Neddermeyer (1936) have, however, led them to revise their former conclusions, and their new and more accurate experiments show that up to energies of 300 million e-volts (the highest energies measured in their experiments) and probably higher, the experimentally measured energy loss of fast electrons is in agreement with that predicted theoretically. In fact, one may say that at the moment there are no direct measurements of energy loss by fast electrons which conclusively prove a breakdown of the theory. This is particularly satisfactory, inasmuch as the theoretical reasons for expecting a breakdown of the theoretical formulae at energies greater than about 137 mc^2, namely the neglect of the classical "radius" of the electron, have been shown by v.Weizsäcker(1934) and Williams (1934) to be unfounded. Under these circumstances, and in view of the experimental evidence mentioned above, it is reasonable as a working hypothesis to assume the theoretical formulae for energy loss and pair creation to be valid for all energies, however high, and to work out the consequences which result from them.

Homi Bhabha and Cecil Powell

About the importance of Bhabha's research work, Cecil Powell, who was awarded the 1950 Nobel Prize for physics, wrote :

"Homi Bhabha made decisive contributions to our understanding of how they (the showers) developed in terms of electromagnetic processes. He was also well-known at this time for his attempts to account for those elementary particles then known to exist by a method using group theory. He was thus a very early exponent of those methods used many years later for a similar purpose by Gell-Mann and others."

Bhabha with C.V. Raman, Vikram Sarabhai and others during the visit of R.A. Millikan to IISc in 1940.

'I have been contemplating carrying out high altitude flights in India at places in addition to those at which you did your beautiful experiments, and if possible with lead between the counters for measurements on the penetrating component. We are now starting work on these experiments in spite of the great difficulties due to the War.'

- From Bhabha's letter to R.A. Millikan, Nobel Prize winner in 1923, written in 1942

RETURN TO INDIA

It is a considerable sacrifice for a working scientist to take time from his research in order to do non-academic work. But for Bhabha, the choice was instinctive. He chose the national project.

Returning to India in 1939, he was thirty years old and at the peak of his scientific career. He was accomplished, peer-recognized and deeply engaged in path-breaking research in an emerging area of science.

Yet the vision of a modern India, at the cusp of independence, led the young scientist along a new direction as a builder of great institutions. His IISc years gave him a renewed sense of identity with the land of his birth. The acute sense of isolation that he felt as a scientist in India, cut off from the enriching intellectual environment of Europe, only made him more determined to create such an atmosphere in India.

The institute that he proposed to set up, "a school of physics comparable with the best anywhere," would attract and train outstanding researchers for the task of building a modern nation.

My dear Sir Sorab,

I have for some time past nurtured the idea of founding a first class school of research in the most advanced branches of physics in Bombay. I had intended putting my scheme before you in person on my next visit to Bombay, but as a result of a letter from Prof. Choksi I am now sending it in writing for your consideration, and I would be glad to have your views on it. If you so desire I am prepared to come to Bombay to explain the scheme to the Trustees in person.

The scheme I am submitting now is not one which has been hastily conceived. It has been germinating in my mind for nearly two years, and I recently discussed it at length with Professor A.V.Hill, Senior Secretary of the Royal Society, apart from being an eminent scientist himself, is one who has a great and intimate knowledge of the organisation of science and scientific institutions in England, and the many valuable suggestions he made have been incorporated in the scheme as it stands now. The scheme has been set forth on the accompanying schedule and is a simple one, but I should like to make a few remarks to explain its background.

There is at the moment in India no big school of research in the fundamental problems of physics, both theoretical and experimental. There are however scattered all

"India is not a land where science cannot be carried on"

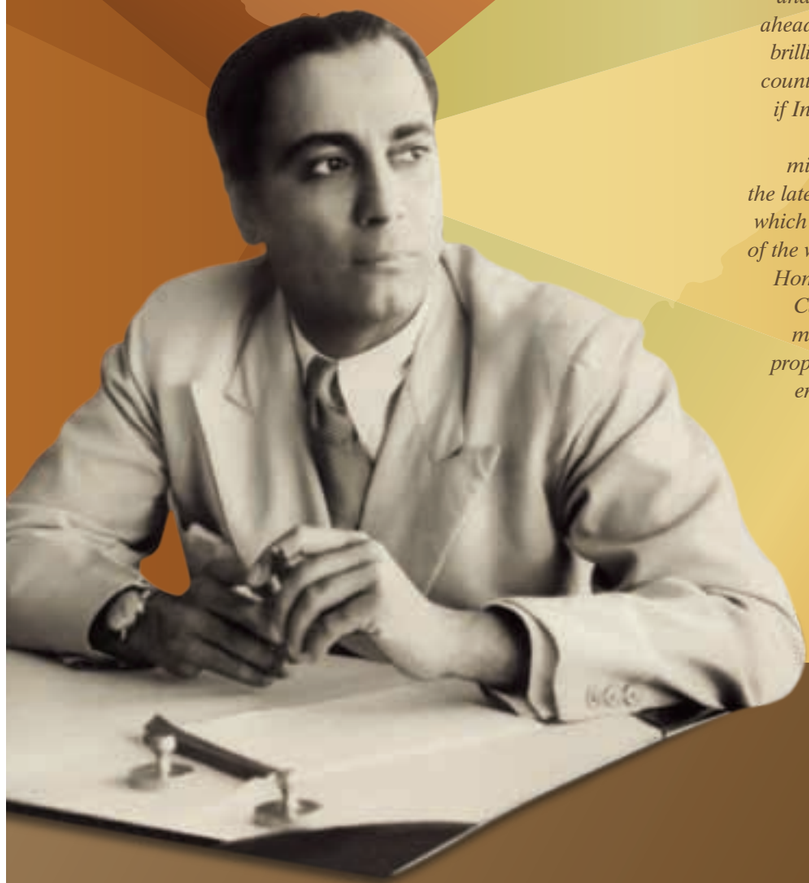
The Indian Institute of Science, Bangalore

Bhabha's commitment to India began with his childhood in Bombay, where inspired and determined figures who were concerned about building a modern India were part of the freedom struggle. At every step, he was deeply confident about India's potential. "India is not a land where science cannot be carried on," wrote the 19-year old to his father from Cambridge in 1928.

When the outbreak of war in 1939 prevented his return to England, he immersed himself in research at IISc, Bangalore. His involvement with the narrative of a developing India deepened during this period. Writing to Sir Sorab Saklatvala of the Sir Dorabji Tata Trust in 1944, Bhabha shared his conviction that it was the duty of Indian scientists to remain in the country and build institutions of the same quality as the best institutions in the world.

NATION BUILDING

TOWARDS A MODERN INDIA



"As I viewed the troubled scene of the thirties and the formidable problems and dangers ahead, I was convinced that only an elite of brilliant and dedicated men could take the country forward to its high destiny, and that if India was to achieve the rate of progress essential to the welfare of its teeming millions, it must bring to bear to the task the latest advances in science and technology which were transforming so much of the rest of the world. The appearance on the scene of Homi Bhabha in 1943, on his return from Cambridge, with his immensely talented mind steeped in modern science and his prophetic vision of the potential of nuclear energy, seemed a truly predestined one."

- J.R.D. Tata, from the foreword to TIFR's Silver Jubilee Commemoration Volume (1970)

As early as 1944, over a year before the military use of atomic energy in Hiroshima, Bhabha planned that the new institute should also conduct research in nuclear energy in order to develop an indigenous atomic energy programme, which he felt was vital for India's development.

Bhabha briefing Prime Minister Nehru during his visit to Trombay. The Atomic Energy Establishment, Trombay, was inaugurated in 1957.

ATOMIC ENERGY FOR NATIONAL DEVELOPMENT

In 1955, when presiding over the first International Conference on the Peaceful Uses of Atomic Energy held under the auspices of the UN, Bhabha would reiterate the need for atomic energy for development : *"For the full industrialization of the underdeveloped countries, for the continuation of our civilisation and its further development, atomic energy is not merely an aid, it is an absolute necessity. The acquisition by man of the knowledge of how to release and use atomic energy must be recognized as the third great epoch in human history."*

Bhabha presiding over the First International Conference on Peaceful Uses of Atomic Energy in Geneva, 1955

Bhabha in front of the 1 MeV Cascade Generator in TIFR

VISION OF A MODERN INDIA

The vision of a self-confident and modern India, compelled Bhabha to chart out this new course for Indian scientific research. TIFR's Silver Jubilee Commemoration Volume (1970) describes this early vision : *"He had established an identity between himself and his country and wanted to remain in it and play his role in its development. In order to do this he felt it was essential to set up a new institution, concerned with scientific development in the topical, sophisticated and frontier areas of science and technology, with modern concepts of administration and research management, which had an atmosphere and environment conducive to the growth of a scientific community and of self-confidence, and which would act as a pace-setter and be the base from which major ventures could be undertaken."*

Bhabha speaking at the inauguration of the new buildings of TIFR, January 15, 1962

"Those were six very happy and fruitful years in my life..."
- Bhabha on his days at IISc, Bangalore

RESEARCH AT IISC BANGALORE

At the Indian Institute of Science (IISc), Bangalore, Bhabha initiated and guided research on cosmic rays, setting up a Cosmic Ray Research Unit and organizing a group of young researchers in experimental and theoretical aspects of research. He also continued his work on relativistic equations of higher spin, known as 'Bhabha-Corben equations'. One of the main motivations to develop and generalize the Dirac equation was to treat the effect of a large number of soft radiation quanta (photons, mesons, etc) using a classical wave field. In modern parlance, the classical wave field is related to the coherent state of the radiation quanta. Bhabha's work on meson theory led him to predict isobar states of the meson-nucleon system. This work was a precursor to later developments in strong coupling theory of the meson-nucleon system.

Balloon experiments, Bangalore

Bhabha with C.V.Raman and others at IISc, Bangalore

'The building itself is only a shell to make possible the work that is done inside it'

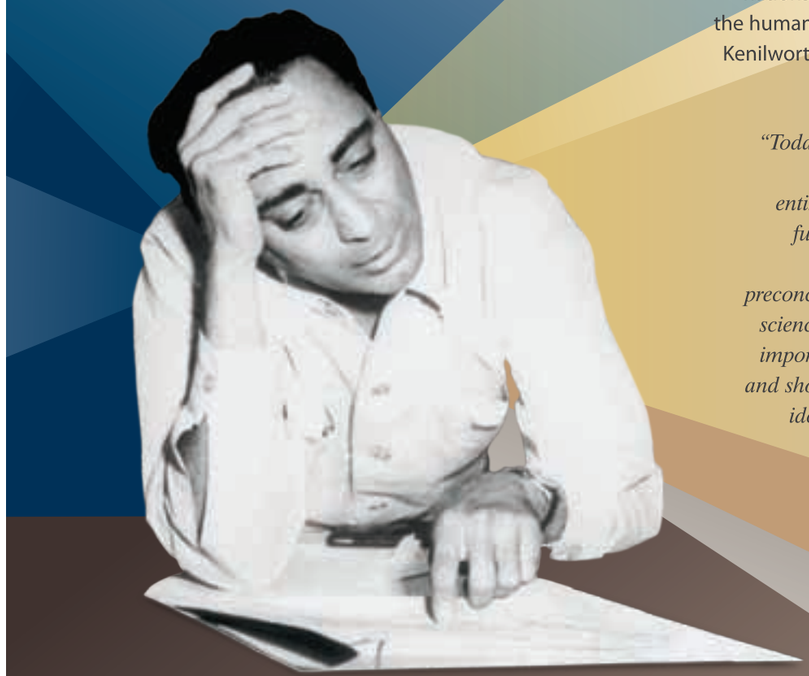
Tata Institute of Fundamental Research

TIFR, the first of India's post-war national research institutes, had started functioning from Bangalore in June 1945. Yet, as Bhabha reminded the gathering at the inauguration of the new buildings in 1962, the institute's own campus had only come up after more than sixteen years. By then, TIFR had already been the birthplace of several initiatives of national significance, including work in electronics, computer science, and the atomic energy programme.

In an inspiring speech at the inauguration of the new campus, Bhabha reiterated the rigorous ethic of the institute : *"The building itself is only a shell to make possible the work that is done inside it. It is by the quality and volume of its scientific work that an Institute like this must be judged, by the extent to which it has helped to explore and push back the frontiers of knowledge, to open up new fields of knowledge, to provide the country with men highly trained in the newest fields of scientific endeavour and able to make their own contribution to the increase of scientific knowledge, and by its general impact on the scientific life of the country as a whole."*

INSTITUTION BUILDING

BRICK BY BRICK...



The value of pure research

In Bhabha's vision, science could transform the lives of people and shape the destinies of nations. It could also open new pathways for the human imagination. His inaugural lecture at Kenilworth on December 19, 1945 highlighted this aspect of pure research:

"Today we all know of the great importance of fundamental research and... how entirely new avenues can be opened up by fundamental research, namely the study of nature foritself unhampered by any preconceived practical ends...The progress of science has also been of great philosophical importance in widening our mental horizon and showing the limitations of commonsense ideas based upon the world immediately perceived by our senses."

Bhabha speaking at the inauguration of TIFR at Kenilworth. John Colville and Sorab Saklatvala are seen sitting

The Old Yacht Club, which continues to be the location of the Department of Atomic Energy

WWII Military hutments on the Colaba site

Proposed site at Colaba

RAPID GROWTH AND THE NEW CAMPUS

The new institute grew rapidly. Within four years, in 1949, it had to move from the 6000 square feet of space it occupied in the Kenilworth bungalow to 35,000 square feet at the Old Yacht Club near the Gateway of India.

While research at TIFR continued at full intensity, every detail of the new campus was planned with its American architects and their Indian associates. Bhabha was keenly involved in discussions about the design, architecture and high construction standards of the new buildings. He especially insisted on the development of indigenous capability as far as possible even in the building technology: for example, the special large sections for windows and doors, in a rustless alloy resistant to corrosion by the sea air, were fabricated in India for the first time.

In the 1950s, the institute moved again, this time to a permanent home on a site overlooking the Arabian Sea in Colaba, where it spread itself out over 256,000 square feet of built-up area on a fifteen-acre campus. An important reason for choosing Colaba was the proximity to the University of Bombay. Bhabha stressed the need to link research and teaching :
"Contact with students is a revitalizing factor for the research worker and conversely we feel that the presence of the Institute here will be of some advantage to the University."

THE OPTIMISM OF CREATIVE WORK

On January 1, 1954, Prime Minister Jawaharlal Nehru laid the foundation stone of the TIFR campus at Colaba, Mumbai. In his address on the occasion, Bhabha reiterated the need to begin working without waiting for facilities to come up :
"The foundation stone is being laid today eight-and-a-half years after the Institute was founded...I remember when the Institute was opened, the Chairman of the Council in his speech said, 'We have not in the usual way waited for the completion of new buildings before commencing our research activities, but have, so to speak, plunged in medias res'. I regard this as a happy augury for the future because, in creative work of this kind, what matters most is the enthusiasm of those concerned with it."

"The Institute appointed for its architect a well-known American firm, Holabird, Root & Burgee because till today they have designed several laboratories, including one for the U.S. Atomic Energy Commission.... The designing of the buildings was done with great care. There was constant talk between the architects and the scientists in the designing and at the last stage the architects actually asked the scientific workers to mark on the plans every piece of major equipment and even the furniture that was going into each place so that the areas and the rooms and the buildings should be very intimately correlated."

Prime Minister Jawaharlal Nehru during the foundation stone laying ceremony

Pandit Nehru, JRD Tata and S.S. Bhatnagar at the foundation stone laying ceremony

Pandit Nehru laying the foundation stone of the institute building

Bhabha speaking during the foundation stone laying ceremony

Eight years later, on January 15, 1962, meeting TIFR's scientists at the inauguration of the institute's new buildings. Nehru echoed this optimistic outlook :
"It is in meeting them and finding out what they have been doing, that I have felt so hopeful, so optimistic about the future of science in India."

CREATING DEPARTMENTS, BUILDING TEAMS

The first departments in the new institute were those of high energy physics, cosmic rays and mathematics, led by scientists like R.R. Daniel, B.V. Sreekantan, D.D. Kosambi and F.W. Levi. New departments were created and research was expanded as the institute attracted talent. In 1949, the mathematician K Chandrasekharan, who was working at the Institute for Advanced Study at Princeton then, joined the institute.

Bernard Peters joined TIFR in 1951 as a Professor in Experimental Physics and stayed on till 1958, leading research work on cosmic rays and nuclear emulsions.

Under scientists like M.G.K. Menon, B.M. Udgaonkar, K.S. Singhvi and R Narasimhan, TIFR's activities expanded to include nuclear physics, condensed matter physics and computer science.

S.S. Dharmatti, who joined TIFR in 1953, developed an interdisciplinary programme in which both physicists and chemists were involved in using the phenomenon of nuclear magnetic resonance.

In the early 1960s, Obaid Siddiqi and Govind Swarup joined the institute to set up and lead the molecular biology and radio astronomy departments respectively.

The central workshop had its beginning in mid-1946 when the institute was still housed in Kenilworth. From the beginning, the workshop played a critical role in the institute. Bhabha had recognized the potential of H.L.N. Murthy and invited him to join TIFR in January 1946. One of the first things Murthy did was to make a Geiger-Muller counter, which aided cosmic ray research at TIFR.

Rock Magnetism Hydrology, designed and developed at TIFR

Liquid Nitrogen Plant in TIFR

A 60 MHz high resolution NMR spectrometer used for chemical research work

In the words of M.G.K.Menon, Bhabha excelled in "institution building for a directed purpose". His emphasis on both theoretical and experimental research at TIFR resulted in some pioneering efforts.

Homi Bhabha with M.G.K. Menon

CHARTING THE COURSE

Initially, experimental research at TIFR related largely to cosmic rays, with first Bhabha himself and then Bernard Peters leading the balloon flight experiments. The experimental groups started working from the Colaba campus from 1954, even before construction began on the site, with the World War II barracks becoming their temporary laboratories. Under Peters, TIFR developed the technique of using stripped emulsions for the first time in the world in 1951-52, which led to the discovery of the K-meson in 1953.

In another pioneering experiment in 1950-52, B.V. Sreekantan took a cosmic-ray telescope into the Kolar Gold Mines to measure the intensity of muons at a depth of 300 metres.

In 1954, the Geophysics Research Group was formed and within five years, under Devendra Lal, it had discovered five new isotopes produced by cosmic rays.

Under Govind Swarup the Kalyan interferometer was put into operation by June 1965. Work on the Ooty Radio Telescope also began by late 1965.

The thrust on experimental research enabled TIFR to build expertise in fabricating equipment. Under M.G.K. Menon, it perfected the manufacture of plastic balloons. In its early days, the institute also built large multi-plate cloud chambers. Through the 1950s, it developed a series of accelerators to facilitate research in nuclear physics.

The first full-scale electronic digital computer designed and built in India, the TIFR Automatic Calculator or TIFRAC, was commissioned in February 1960 by R. Narasimhan and his team.

Balloon flights

Phase-I Nucleon Decay Detector at the Kolar Gold Mines

Kalyan Radio Telescope

TIFRAC

TIFR's scientists were exposed to the latest currents in research internationally. The new institute attracted distinguished international scientists as visitors, including Paul Dirac, Niels Bohr, Wolfgang Pauli, Laurent Schwartz, Cecil Powell, John Cockcroft, Bruno Rossi and P.M.S. Blackett. Blackett gave his first lectures on cosmic rays at TIFR as far back as 1947, in the earliest days of the institute. Between 1947 and 1964, honorary fellowships of the institute were conferred on John Mathai, Jawaharlal Nehru, Paul Dirac, Carl Siegel, Niels Bohr, and John Cockcroft.

Niels Bohr with Bhabha, J.R.D. Tata and Jamshed Bhabha during the International Colloquium on Function Theory in 1960

A HUB OF MODERN SCIENCE

TIFR also began to host international colloquia to further these exchanges. In 1950, an International Conference on Elementary Particles was hosted in Mumbai. At the concluding session, Blackett expressed appreciation for the care and commitment with which the conference had been organised :
"I must say in my experience I have never attended a conference which was both so interesting scientifically and so well organised and in such a beautiful place. Actually I have found this conference exceptionally valuable to me. Then again it pleases me to see so many young Indian scientists from whom we expect great things in the future..."

An International Conference on Cosmic Rays was hosted in Jaipur in 1963. The first Summer School in Theoretical Physics, held in 1961 at Bangalore, had M.Gell-Mann and R.H.Dalitz as lecturers. The School of Mathematics began to host an international colloquium every four years, beginning with one on Zeta Functions (1956), followed by Function Theory (1960), Differential Analysis (1964) and so on. TIFR fast became a hub of modern science.

Despite his growing preoccupations as policy-maker and international statesman of science, Bhabha himself remained a constant source of inspiration to the young scientists who converged at TIFR. A deeply involved and imaginative administrator, he led the institute as Director and Professor of Theoretical Physics for two decades.

Geophysicist Devendra Lal, who began his scientific career at the age of 20 at TIFR, was one of the early generations of researchers who felt inspired by Bhabha's leadership. *"Interactions with Dr Bhabha, remote or direct, infused me with energy and excitement to do fundamental and creative science...Every meeting with him changed me, and inculcated in me a new view of science, and how a scientist should think."*

Bhabha with Cecil Powell, Patrick Blackett and Vikram Sarabhai

The first Summer School in Theoretical Physics at Bangalore in 1961

International Colloquium on Function Theory at the Old Yacht Club

International Conference on Elementary Particles hosted by TIFR in 1950

Atomic Energy Establishment, Trombay

In India, in addition to his advocacy which had led to the Atomic Energy Act 1948, Bhabha became increasingly involved with policy-making at the national level. He was a principal architect of the Government of India's Scientific Policy Resolution, 1958. He also chaired the Government Electronics Committee. He was a member of the Scientific Advisory Committee to the Cabinet, and its Chairman from July 1964 until his death. In 1962, he initiated the Indian space programme by setting up the Indian National Committee for Space research headed by Vikram Sarabhai.

In Menon's words, Bhabha's approach to science policy "believed in a landscaping which took into account what already existed":
"His aim was not to bulldoze all that existed and plant science and technology as a shining imported item and to create a uniform faceless society - but to grow science indigenously, as a way of life in the midst of all that was good and great from the past, a science which would bear the imprint of the traditions, the culture and natural gifts of the Indian people."

POLICY MAKING

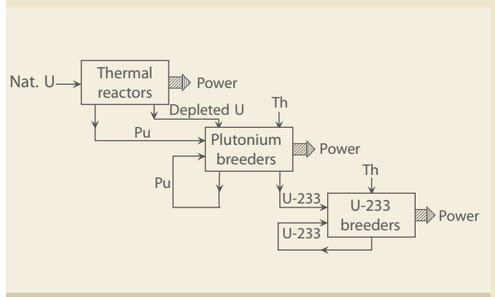
LEADING THE WAY

"The key to national prosperity, apart from the spirit of the people, lies, in the modern age, in the effective combination of three factors, technology, raw materials and capital, of which the first is perhaps the most important, since the creation and adoption of new scientific techniques can, in fact, make up for a deficiency in natural resources, and reduce the demands on capital. But technology can only grow out of the study of science and its applications."

- Opening statement of the Government of India's Scientific Policy Resolution, 1958, of which Bhabha was one of the principal architects.

Bhabha with reactor engineers at Trombay

Atomic Energy Establishment, Trombay



Strategy for Nuclear Power in India

THE ATOMIC ENERGY COMMISSION

From the outset, Bhabha was acutely aware of the need to plan for the growing energy requirements of a developing nation. In his proposal for the new institute in 1944, he emphasised the need for research into nuclear physics :
"When nuclear energy has been successfully applied for power production in, say, a couple of decades from now, India will not have to look abroad for its experts but will find them ready at hand."

This was soon followed by a plan for the country's nuclear power policy which Bhabha set out in a note entitled "Organisation of Atomic Research in India" addressed to Prime Minister Nehru on April 26, 1948. At the time, an advisory Board of Research on Atomic Energy, chaired by Bhabha, functioned as a part of the Council for Scientific and Industrial Research. In his note, Bhabha proposed the creation of an Atomic Energy Commission (AEC) :
"The development of atomic energy should be entrusted to a very small and high-powered body composed of, say, three people with executive power, and answerable directly to the Prime Minister without any intervening link. For brevity, this body may be referred as the Atomic Energy Commission."

The Government soon accepted the proposal and passed legislation creating the Atomic Energy Commission (AEC). The first Commission was chaired by Bhabha with S.S. Bhatnagar and K.S. Krishnan as the other members.

DEVELOPING THE ATOMIC ENERGY PROGRAMME

TIFR became, in Bhabha's words, the "cradle of the atomic energy programme". It was here that the early work of the AEC began, training scientists and building capacity for the country's atomic energy programme.

Early figures of the programme who came from TIFR included Raja Ramanna and A.S. Rao. Joint teams of scientists from TIFR and from the AEC, who worked from TIFR's premises, began to undertake some of the first atomic energy projects in the country.

Identifying the need for electronics instruments for atomic energy projects, TIFR set up a small electronics group for the AEC under A.S. Rao.

Groups working in related fields like accelerators, software technology and semiconductor technology also gradually came up at TIFR. The control system of APSARA, the country's first reactor, was built in the barracks on TIFR's Colaba site before the campus buildings were constructed.

In his address at the inauguration of the TIFR campus in 1962, Bhabha recognised the contribution of TIFR to the atomic energy programme :
"If the Atomic Energy Establishment has been able to develop so fast, it is due to the assisted take-off which was given to it by the Institute in the early stages of its development."

Bhabha and Homi Sethna supervising work in Trombay

Bhabha with Prime Minister Nehru in Trombay

April 26, 1948

Note on the Organisation of Atomic Research in India

by

H.J. Bhabha
Chairman
Board of Research on Atomic Energy

1. The Report submitted to you, Mr Prime Minister, on my return from Europe and America collected evidence which made it reasonable to believe that within the next couple of decades atomic energy would play an important part in the economy and the industry of countries and that, if India did not wish to fall even further behind the industrially advanced countries of the world, it would be necessary to take more energetic measures to develop this branch of science and appropriate larger sums for the purpose.
An immediate objective should be the setting up of a small atomic pile. Resolution 1 of the last meeting of the Board of Research on Atomic Energy given in the appendix supports this proposal.

2. In that Report it was pointed out that the quickest and most desirable way of developing atomic energy in India would be to come to an agreement with the Governments or atomic energy agencies of one or more countries such as Great Britain, France and Norway. Such agreements would be on mutually advantageous terms involving the exchange of raw materials used in the generation of atomic energy and the pooling of scientific and technical information.

3. It must be clearly understood that the possession of sufficient quantities of uranium is a *sine qua non* for the generation of atomic energy. Thorium can only be used for this purpose after it has been treated in an atomic pile in such a way as to generate a particular variety of uranium in it. A pile cannot be started without uranium, or plutonium, which is a substance generated from uranium in a pile.

4. So far no large and concentrated deposits of uranium bearing minerals have been found in India, though the monazite sands of South India contain a fraction of a per cent of uranium. It is essential, therefore, that our immediate programme should include an extensive and intense search for sources of uranium. These geological surveys would take at least two years if carried out in any careful and exhaustive way, and it is possible that their result may be negative. In that case India would either have to depend on an agreement with a foreign power for the purchase of her uranium or go in for the much more costly process of extracting uranium from monazite. If, therefore, the Indian Government wishes to possess a pile in operating condition in India within a period of a few years, then an agreement with a foreign atomic energy agency is inevitable.

5. In deciding on the structure of the organization which Government must set up in order to develop atomic energy and research on a bigger and more effective scale than hitherto the following two basic facts of the situation must be taken into account.

(i) Absolute secrecy will have to be observed and ensured with respect to any secret information given to us by a foreign atomic energy agency.

(ii) The paucity of the scientifically and technically trained personnel will require some of the top people to do more than one job at the same time.
These two conditions by themselves practically determine the essential structure of the organisation.

6. Condition (i) requires that the development of atomic energy should be entrusted to a very small and high-powered body composed of say three people with executive power, and answerable directly to the Prime Minister without any intervening link. For brevity, this body may be referred to as the Atomic Energy Commission.

The present Board of Research on Atomic Energy cannot be entrusted with this work since it is an advisory body which reports to the Governing Body of the Council of Scientific and Industrial Research, composed of 28 members including officials, scientists and industrialists. Secret matters cannot be dealt with under this organisation.

7. The same conditions of security require that the Atomic Energy Commission have its own secretariat independent of the secretariat of any other Ministry or Department of Government, including the envisaged Department of Scientific and Industrial Research.

8. In the chart of the proposed Department of Scientific and Industrial Research which was given to me by Sir S.S. Bhatnagar on your instructions, the present Board of Research on Atomic Energy is shown as a part of this Department but not under the Council of Scientific and Industrial Research as at present. The reasons regarding security etc. which have been given above make this arrangement undesirable and I have, therefore, given in Appendix II a modification of this chart which only differs from the original chart given to me in having the Atomic Energy Commission directly under the Prime Minister and not as part of the Department of Scientific and Industrial Research. In my opinion, already expressed to you in a letter from Simla in June, 1947, it is desirable that the Department of Scientific and Industrial Research should be under the Prime Minister. I understand, however, that there is a possibility that it may be put under a Minister without portfolio who would be in charge of its day to day operation. Should this step become necessary through force of circumstances then it will be necessary to separate the Atomic Energy Commission from the Department of Scientific and Industrial Research if it is now made a part of that Department. The Atomic Energy Commission whose work has important international implications must always be attached directly to the Prime Minister, and I am, therefore, strongly of the opinion that it should from the start be organised directly under the Prime Minister and not as a part of the Department of Scientific and Industrial Research. Full co-ordination of the activities of the Department of Scientific and Industrial Research would be ensured by the circumstance that the Director of Scientific and Industrial Research would be a member of the Commission and act as its Secretary for ordinary administrative purposes.

EARLY STEPS, DAE AND AEET

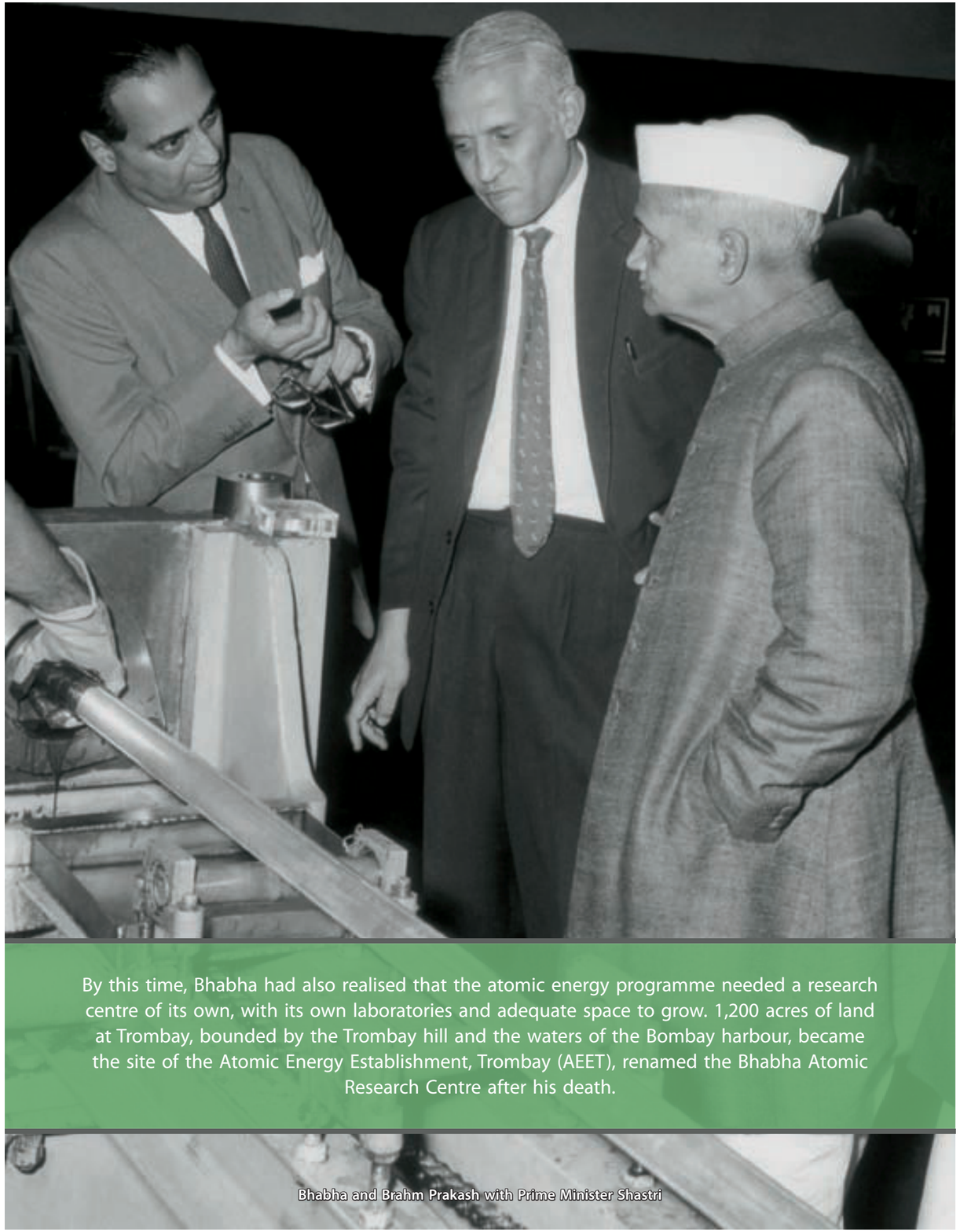
With the setting up of the three-member Commission, Bhabha now turned his attention to steering the programme. One of the first acts of the AEC was to initiate a survey of India's natural resources, especially atomic minerals like uranium and thorium-bearing minerals, with a view to achieving eventual self-sufficiency in the fuel-cycle operation. A second task was to promote and nurture research in nuclear physics in the country.

Bhabha's close relationship with Nehru played a key role in the atomic energy programme as well. As work on atomic energy gathered momentum, Bhabha realised that the AEC, essentially a policy-making body, would not be enough : the programme required a full-fledged Department of the Government to implement it.

In 1954, Bhabha proposed to Nehru that the Government of India establish a Department of Atomic Energy (DAE) to fund, create and operate all the facilities required for the nation's atomic energy programme. The department was set up in the same year, with Bhabha as Secretary to the Government of India. Based in Bombay instead of Delhi, the DAE functioned directly under the Prime Minister, a model that is still followed today.

With Prime Minister Nehru in Trombay

Bhabha with Prime Minister Nehru
at the inauguration of AEET, 1957



Bhabha and Brahm Prakash with Prime Minister Shastri

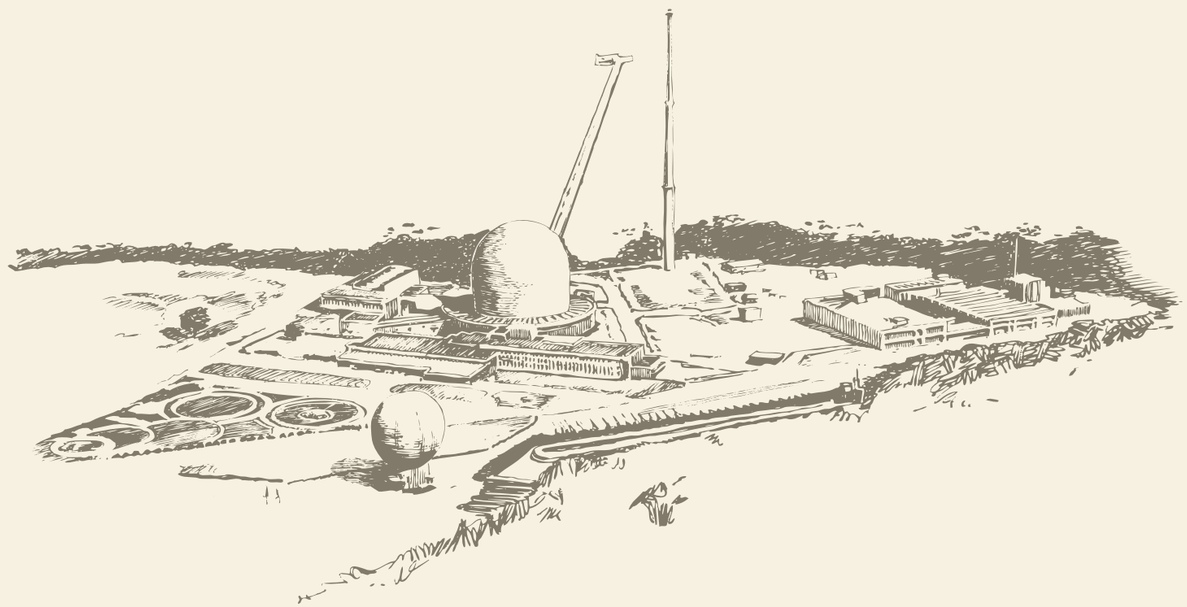
By this time, Bhabha had also realised that the atomic energy programme needed a research centre of its own, with its own laboratories and adequate space to grow. 1,200 acres of land at Trombay, bounded by the Trombay hill and the waters of the Bombay harbour, became the site of the Atomic Energy Establishment, Trombay (AEET), renamed the Bhabha Atomic Research Centre after his death.

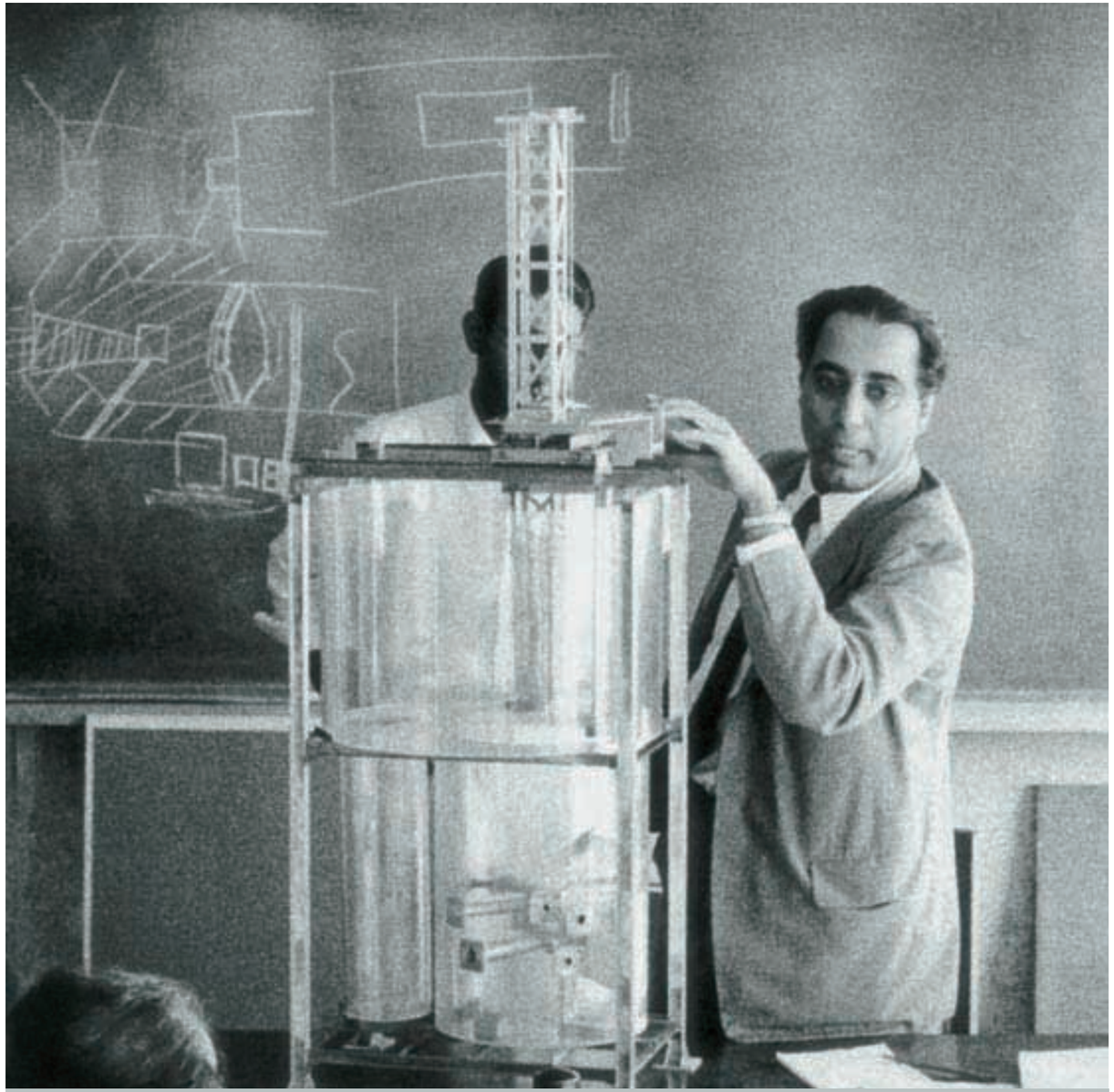
TROMBAY

Bhabha took up the Trombay project with the same care and passion that he gave to everything he undertook, beginning with the landscape. In an account of his visit to Bhabha's home in 1954, von Leyden wrote :
"Near his desk stood an enormous drawing board with huge printed plans pinned to it. It appeared that they were the first layout for the afforestation scheme and suggested gardens at Trombay. He spent many hours at night poring over these plans, trying to visualise in his mind's eye the setting of this new city which he had founded and built mostly below the tree-grown flanks of Trombay Hill… It was typical of him that he could visualise the final shape of 'his' city only in its complete harmonious integration into the surrounding landscape."

Bhabha inaugurating the 3000 feet long jetty at Trombay

Atomic Energy Establishment, Trombay





Much of the work of the AEET was initiated at TIFR. It was here, in March 1955, that Bhabha took the decision to build India's first reactor, APSARA, a swimming pool or light-water reactor. A complete drawing and full model of APSARA's control room was made at TIFR. Its control equipment was built by the electronics group at Colaba while its mechanical equipment was fabricated in TIFR's workshop.

Bhabha discussing the construction of the APSARA reactor in 1955

THE FIRST REACTORS: APSARA AND CIRUS

APSARA was thus designed, engineered and built in-house by Indian scientists and engineers. The enriched fuel elements were supplied by the United Kingdom Atomic Energy Authority. APSARA was commissioned on August 4, 1956.

Meanwhile Bhabha had already proposed the creation of the country's first heavy-water reactor, a critical step towards his dream for nuclear power for India.
The Canada-India Research Reactor or CIRUS, which was set up in collaboration with Canada, attained criticality in 1960. India's atomic energy programme had been launched.

1955 UN CONFERENCE

Bhabha's contribution to atomic energy was internationally recognized when he was unanimously appointed by the United Nations as President of the First International Conference on the Peaceful Uses of Atomic Energy in Geneva in 1955. In a memorable presidential address on energy and development, he predicted the emergence of nucl-ear power as a solution to the world's energy needs, and thus as the way to a better life :
"Those who have the good fortune to participate in this Conference are privileged to be in the vanguard of the march of history...I hope this conference will play its part in helping the progress of mankind towards the ever-widening dawn of the atomic age, with the promise of a life, fuller and happier than anything we can visualize today."

As a member of the Scientific Advisory Committee of the International Atomic Energy Agency, Bhabha continued to be a strong advocate of international scientific cooperation as well.

APSARA

Bhabha with Dag Hammarskjold, Walter Whitman and others at the First International Conference on the Peaceful Uses of Atomic Energy, Geneva 1955.

Early Influences

Bhabha's love for the arts began early, in an environment pervaded by music and culture. His grandfather's vast library opened up a world of imagination for the young boy. His father's equally impressive collection of books on art and music, collected during his student years in Oxford and London, revealed further worlds that he would grow to love.

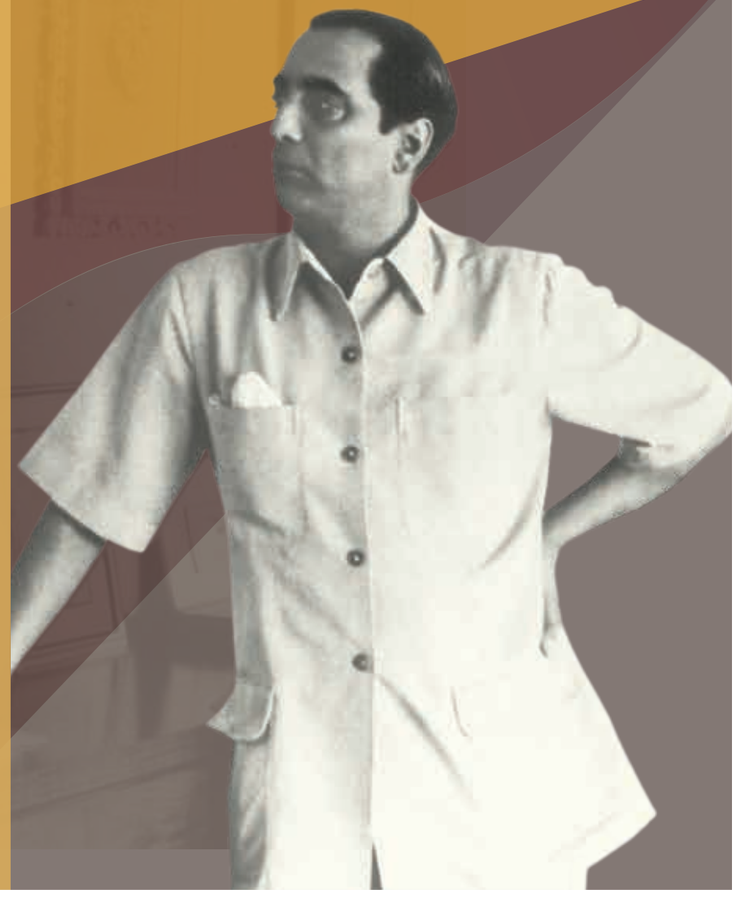
In their teenage years, Homi, his brother and their cousin would spend hours listening to the family's large collection of gramophone records of Western classical music. It became a ritual for the three young people to take turns winding the gramophone, turning over the records and sit in absolute silence, with lights dimmed, absorbing the music as it played.

By the age of 16, Homi was already familiar with the music and operas of the great European composers. Art, music and literature would remain his lifelong companions.

PATRONAGE OF THE ARTS

THE MODERN LEONARDO DA VINCI

"I know quite clearly what I want out of life. Life and my emotions are the only things I am conscious of. I love consciousness of life and I want as much of it as I can get. But the span of one's life is limited. What comes after death no one knows. Nor do I care. Since, therefore, I cannot increase the content of life by increasing its duration, I will increase it by increasing its intensity. Art, music, poetry and everything that I can do have this one purpose – increasing the intensity of my consciousness and life."



Bhabha painting the 'Dove sono I belli momenti' in Cambridge. Photograph by Lettice Ramsay

Stage set for Mozart's opera Idomeneo designed by Bhabha in Cambridge

WHAT MADE LIFE WORTH LIVING

According to his brother Jamshed, Homi was as passionate about the arts as he was about science :
"For Homi Bhabha, the arts were not just a form of recreation or pleasant relaxation; they were among the most serious pursuits of life and he attached just as much importance to them as to his work in mathematics and physics. For him, the arts were, in his own words, 'what made life worth living'."

Bhabha was truly a Renaissance man. Professionally, he was a trained engineer turned physicist of international stature, but equally, a serious painter; a lover of music and literature; a great collector and patron of the arts. In a letter to Nehru, he wrote about the great beauty that was an integral part of his vision for the institutions that he built :
"I think both Trombay and the Tata Institute of Fundamental Research will be architecturally and botanically beautiful when they are completed."

In the words of J.R.D. Tata:
"Scientist, engineer, master-builder and administrator, steeped in humanities, in art and music, Homi was truly a complete man."

THE GREATNESS OF THE WORK

Cambridge opened up a world of art for Bhabha, giving him the opportunity to attend live concerts and hear the music that he loved so much. After attending one such performance of Beethoven's Ninth Symphony, he wrote in a letter to his brother Jamshed :
"It is now almost one o'clock, but I cannot help writing to you. I came back from the concert at about eleven or earlier, and have been thinking of the Ninth Symphony all the time...Never before have I been so moved. The performance was by no means faultless...but all the faults of execution are forgotten in the greatness of the work. I was drawn out of myself and raised to sublime heights, and my mind hardly got back to earth till a long time after the end…"

Inspired by such musical experiences, Bhabha would make it a point to include at least one evening of a musical or dance recital at every conference or event at TIFR.

Ravi Shankar, Alla Rakha, and Yamini Krishnamurthy were among those artistes who gave performances at TIFR.

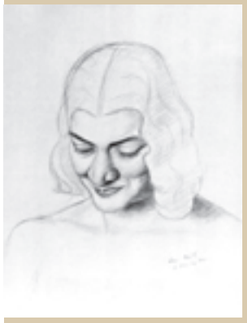
Music was to remain Bhabha's solace till the end, as Jamshed Bhabha reminisced :
"In his last fifteen years, when he became increasingly immersed in the organizational and administrative tasks of building and developing TIFR and the Atomic Energy Centre… he would find relief from tension and fresh stimulus in listening to music at night. There was hardly a single free evening at home when he would not be listening to music after dinner and before taking up again his mathematical work till late at night."

Pandit Ravishankar and Ustad Alla Rakha performing during the Jaipur Conference in 1963

Yamini Krishnamurthy performing during the International Colloquium on Differential Analysis in 1964

Ustad Bismillah Khan with M.G.K Menon

Bhabha's sketch of M.F. Husain



Sketches of Pipsy Wadia and Sarojini Naidu

Sketches of P.M.S. Blackett and Shanta Rao

ART AND NATURE

Art was one of Bhabha's passions. Introducing him at the annual meeting of the Indian Academy in 1941, C.V. Raman described the 32-year old Bhabha as "the modern equivalent of Leonardo da Vinci."

Despite his extensive preoccupations as a policy-maker, Bhabha continued to express his creativity through pencil sketches. Some of his memorable sketches are those of Sarojini Naidu, M.F. Husain and Blackett.

Nature was his other great passion. Bhabha's love for trees and gardens was part of his love for natural beauty. According to SD Vaidya, who was in charge of the parks and gardens in TIFR and AEET, Bhabha wanted the gardens to refresh the spirit of those who worked inside the buildings. Vaidya worked closely with Bhabha's idea of the garden for the new buildings at TIFR, adapting a French model for the West Lawn. About the plans at Trombay, Vaidya recalled a telling incident:
"While planning roads in Trombay he observed from the landscape plan that an old mango tree came in the way of one of the roads. The civil engineers had recommended complete removal of the tree to have a straight road. Dr Bhabha felt that the tree which had lived there for over a hundred years had every right to continue to stay in the same spot. As there was enough space around the tree to modify the road layout, he suggested realignment of the road to save the tree. The tree had given character to the whole area for over a century and is still happily standing there as a living sculpture."

THE BOMBAY PROGRESSIVES AND THE TIFR ART COLLECTION

India's great works of modern art, especially those of the Bombay Progressive Artists' Group which included F.N. Souza, K.H. Ara, M.F. Husain, Tyeb Mehta, and S.H. Raza, and their contemporaries like Jamini Roy, find their place in the foremost individual and institutional collections of art.

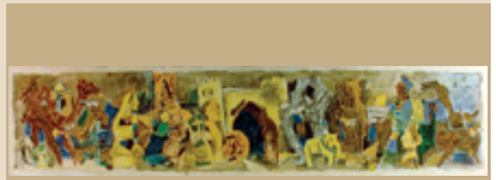
But when these artists were just setting out on the journey that would change the landscape of contemporary Indian art, Homi Bhabha became one of their earliest and foremost patrons.

If he encouraged and inspired the young artists of his times, Bhabha was equally eager to share his appreciation and knowledge of art with the members of the institutions that he built. TIFR would thus emerge as a repository of one of the finest public collections of Modern Indian art.

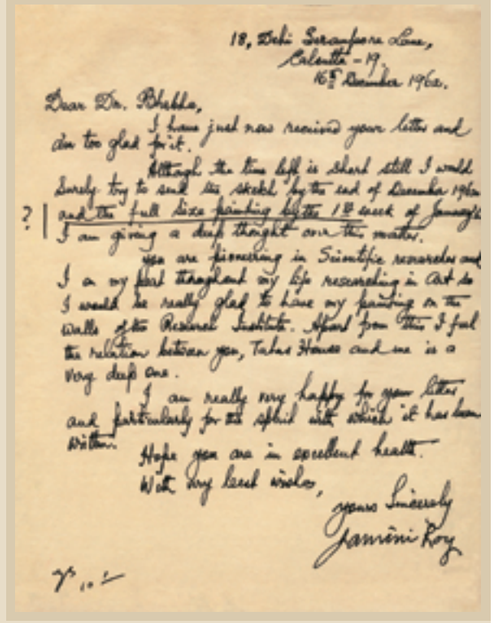
Kekoo Gandhy of Chemould Gallery, who was also instrumental in promoting the Progressive Artists' Group, recalls Bhabha's visit to his framing shop on Princess Street, from where the Progressives had made some of their first sales.*"We soon recognised discerning and interested art patrons and started holding private exhibitions. We had previews for Homi Bhabha, which is why the TIFR has the best private collection of 1940s art."*

In October 1962, Bhabha invited a select list of artists, including K.H. Ara, M.F. Husain, N.S. Bendre, Satish Gujral, K.K. Hebbar, Badri Narayan and Jamini Roy to submit their preliminary designs for a mural in the entrance hall of the new TIFR building at Colaba. From these concept panels, a four-member committee selected Husain's concept for the mural, which Bhabha described as "a more substantial and enduring composition." Today the Husain mural, Bharata Bhagya Vidhata, is one of the most dazzling works in the TIFR collection.

Bhabha in front of one of his paintings.
Photograph by Lettice Ramsay



Mural by M. F. Husain - "Bharat Bhagya Vidhata"



Letter from Jamini Roy to Bhabha

J.R.D. Tata paid tribute to
Bhabha's extraordinary vision:

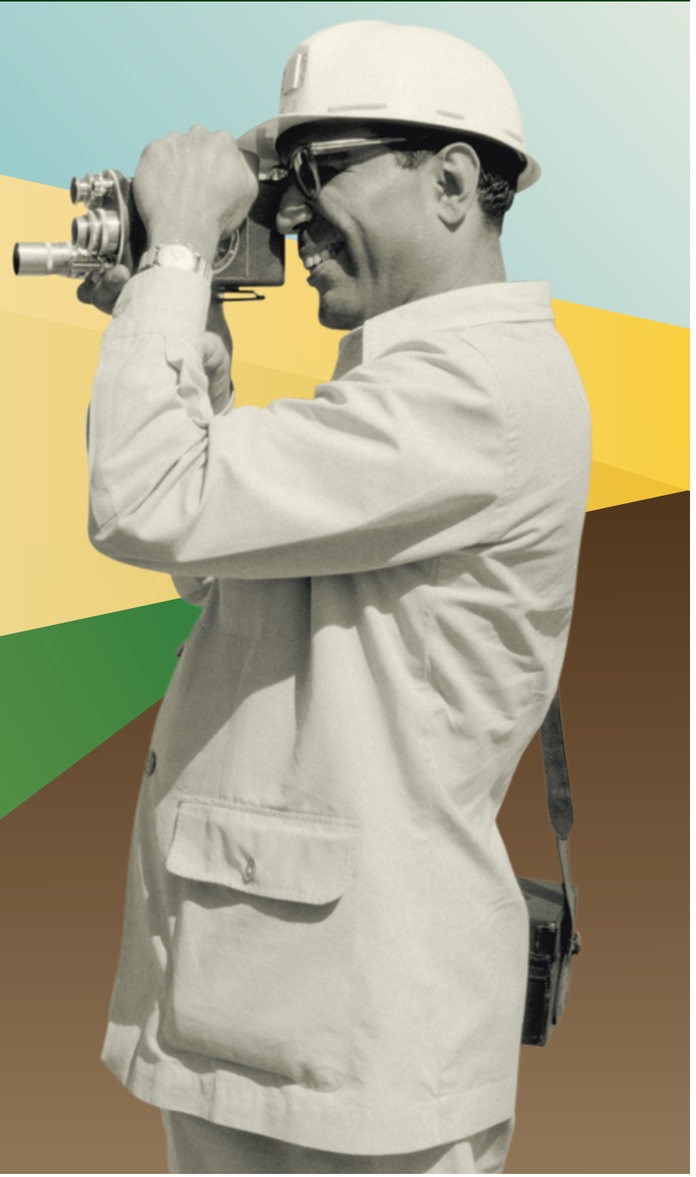
"Homi was one of those who made me believe that some men in human history are born with the stamp of predestination on them which leads them to accomplishments beyond ordinary human capabilities. Some of them – and Homi, alas, was one – are also predestined to die young, an unconscious premonition which drives them to superhuman effort to complete their task in the short time allowed to them…"

THE LEGACY

AN ENDURING VISION

On January 25, 1966, at a condolence meeting for Bhabha, TIFR passed the following resolution in memory of its much-loved founder :

"The hearts of all present are too full to find expression that would be truly fitting and appropriate for this most gifted son of India, whose splendid vision and imagination were ever at the service of his country, whose unsurpassed energy and enthusiasm were a driving force that spurred men on togive of their best, and whose humane and gentle thoughts were for his family and others nearest to him and yet constantly moved out to larger and ever widening circles of all who needed his care, attention and regard."



रजिस्ट्री सं० डी. 221 REGISTERED No. D. 221

भारत का राजपत्र
The Gazette of India

असाधारण

EXTRAORDINARY

भाग I—खण्ड 1

PART I—Section I

प्राधिकार से प्रकाशित

PUBLISHED BY AUTHORITY

सं० 29] नई दिल्ली, मंगलवार, फरवरी 1, 1966/माघ 12, 1887

No. 29] NEW DELHI, TUESDAY, FEBRUARY 1, 1966/MAGHA 12, 1887

इस भाग में भिन्न पृष्ठ संख्या दी जाती है जिससे कि यह अलग संकलन के रूप में रखा जा सके ।

Separate paging is given to this Part in order that it may be filed as a separate compilation

MINISTRY OF HOME AFFAIRS

NOTIFICATION

New Delhi, the 1st February 1966

No. 3/4/66-Pub.II.—The passing away on January 24, 1966, of Dr. Homi Jehangir Bhabha, Secretary to the Government of India, Department of Atomic Energy, Chairman of the Indian Atomic Energy Commission and prime architect of Indian atomic and space research programme, has deprived India and indeed the world of one of its most distinguished scientists. A versatile genius, he had not only made an outstanding contribution which brought him worldwide recognition, to research in the new and exciting field of nuclear physics, but he was also an accomplished artist and musician, a dynamic leader of the scientific community, a brilliant administrator and above all an ardent patriot, who had dedicated himself to the cause of a developing country

UNTIMELY DEATH IN 1966

On January 24, 1966, an Air India Boeing 707 crashed on the Mont Blanc in the Alps, killing everyone on board.

Homi Bhabha, on his way to Vienna to attend a meeting of the Scientific Advisory Committee of the International Atomic Energy Agency, was one of those who lost their lives in the crash.

It was a tragic and most untimely death. It deprived the scientific world of a great physicist and leader, and snatched away from India one of its most dedicated heroes and inspiring visionaries, who had always worked to harness the advancements of science and technology for the development of the country.

In the words of Cockcroft :
"Human progress has always depended on the achievements of a few individuals of outstanding ability and creativeness. Homi Bhabha was one of these."

Mourning at the meeting in Vienna which Bhabha had been scheduled to attend in January 1966

Uthamna ceremony at TIFR

Condolence meeting at BARC

THE INSTITUTE LIVES ON

"The Institute's task will never end, for the frontiers of knowledge will always lie ahead. A relentless pursuit of excellence has characterised and indeed made possible the Institute's achievements, progress and international recognition. May that spirit, instilled in all those who worked with Homi Bhabha, be ever maintained and inspire in the years to come even those to whom he will be but a legend."

- J.R.D. Tata, from the Foreword to 'Tata Institute of Fundamental Research 1945-1970' (Silver Jubilee Commemoration Volume).

J.R.D. Tata speaking at TIFR's
silver jubilee celebrations in 1971

SCIENCE FOR PROGRESS

From the elementary particles to the growing world

In the 1930s, one of Bhabha's notable contributions as a physicist was to the theory of particles of high spin. According to British nuclear physicist Lord Penney, Bhabha "proved in his work that he could see further ahead than most of his contemporaries; as resonances in high energy collisions, particles of higher spin are today part of the observed external world."

Seeing further ahead than most others, Bhabha also saw the critical role that science could play in human advancement, both to uplift a developing country like India and to meet the increasing energy needs of a growing world. As he said at the inauguration of TIFR on December 19, 1945 :
"Science has at last opened up the possibility of freedom for all from long hours of manual drudgery and today we stand at the beginning of an age when every person will have the opportunity to develop himself spiritually to his fullest stature. With the mastery of atomic energy and the accelerating progress of science in other fields, the world in a hundred years time will look as different from today as today is different from the Middle Ages."

Scientific progress as a cornerstone of nation-building

From the beginning, Bhabha's vision for scientific research in India was closely linked to his vision for India itself. Scientific progress was, in Bhabha's mind, a cornerstone of nation-building.

He was also aware that this scientific progress could only be achieved by bringing together the talent scattered across the country onto a common platform that enabled vigorous research into the fundamental principles of the universe as well as its practical applications.

This became his life's mission. From research in the basic sciences and the development of the atomic energy programme, to the industrial applications of that research and the emergence of electronics in India, from setting architectural standards and inculcating an appreciation of the aesthetic to encouraging the spirit of self-reliance and establishing forward-looking social structures in the institutions that he built, Homi Bhabha's vision touched every aspect of a modernising India.

J.R.D. Tata gifting a bronze bust of
Homi Bhabha to TIFR on January 24, 1967

Renowned artist K.H. Ara organised a children's
art competition on Founder's Day, October 30, 1970

The road leading to the institute was renamed
the Homi Bhabha Road on October 17, 1966

Inauguration of the Homi Bhabha
auditorium on November 9, 1968

Bhabha's vision for a scientifically advanced - India encompassed the twin goals of fundamental research in the basic sciences and the development of an atomic energy programme for peaceful uses. It was a vision that he had articulated as far back as 1944, in his first proposal to the Sir Dorabji Tata Trust, and it was this vision that led him to create not one but two towering institutions of science: the TIFR and the Atomic Energy Establishment.

IDEAS, FEELINGS AND DREAMS

In the words of M.G.K. Menon :
"Homi Bhabha died at the peak of his great powers, a legendary figure in his own lifetime, working towards the end with an urgency which had to be seen to be believed, working against time when he felt he had so much to accomplish...He achieved so much; and yet had so much more, of grand designs for India."

In his tribute, Choksi recalled Bhabha's capacity for hard work and determination :
"Again and again have I marvelled at the boundless energy and enthusiasm that he brought to little things as to great, living life to the full and yet sharing an abundant life of ideas, feelings and dreams with his colleagues and friends… We learn from his life the full significance of unremitting toil, combined with a marvellous and steadfast vision [for] contrary to popular notion, how often vision comes from unremitting toil!"

Within two decades, Bhabha had transformed the scientific landscape of the nation. His leadership had inspired the generations of scientists and engineers who worked with him at TIFR and at the Atomic Energy Establishment and soon they, too, had embraced his vision of a new India, developing a new sense of optimism and confidence in their abilities that had never been seen in the country before.

Vikram Sarabhai especially commended, as the real legacy of Homi Bhabha, his unique ability to lead several generations of researchers :
"The confidence and the spirit which Dr. Bhabha was able to generate not only in this Department of Atomic Energy but in countless scientists and the young people who came out of universities and went into the atomic energy training school or other branches of science, the constant support which he secured for these young people – this is the real legacy which he has left to us."

HONOURS AND RECOGNITIONS

- Fellow of the Royal Society, 1941
- Adams Prize, Cambridge, for a thesis on "The theory of the elementary physical particles and their interactions," 1942
- Hopkins Prize of the Cambridge Philosophical Society, 1948
- Padma Bhushan, 1954
- President, First International Conference on Peaceful Uses of Atomic Energy, held under the auspices of the UN, 1955
- Honorary fellowship of the Gonville and Caius College (1957), Royal Society of Edinburgh (1957), American Academy of Arts and Sciences (1959), National Academy of Sciences of the United States (1963)
- Honorary doctoral degrees in science: Patna (1944), Lucknow (1949), Banaras (1950), Agra (1952), Perth (1954), Allahabad (1958), Cambridge (1959), London (1960), Padova (1961)
- President, International Union of Pure and Applied Physics, 1960-63
- Melchett Medal of the Fuel Institute, 1964

RUTHERFORDIUS NOSTER, cum Praeses Societatis Britannicae ad Indiam profecturus orationem pararet, nullius nominatim nisi huius viri mentionem facere decrevit; adeo iam tunc excellebat. Qui patre natus Oxonii alumno et in India sua eruditus Cantabrigiam pervenerat, ubi studia exercuit primum machinalia, deinde physica, stipendiumque ex nomine Isaaci Newton nuncupatum promeritus est. Redux postea in patriam et naturae rationes a vulgari intellegentia remotiores subtiliter scrutatus, meditatus, commentatus, doctrinae physicae in Instituto Tatano Professor evasit. Umbraticus tamen minime est, ut qui domi sit eiusdem Instituti Rector, consiliique Indici Praeses potentiae in atomis latentis regendae causa constituti, foris tanto in honore habeatur ut, cum nuper e multis gentibus legati Genavam convenissent qui de eadem potentia quaererent quomodo ad innoxios usus verteretur, hunc consilii magistrum delegerint.

Sed ad studia ita semper accubuit ut convictui humano et societati vacaverit, linguarum complurium peritus ubique peregrinetur, picturae et musicae artibus ipse exercitatus cum talibus viris libentissime versetur. Quid enim? Traditur idem in Collegio suo quinti remigii gubernator olim fuisse.

Duco ad vos Regiae Societatis Sodalem, Collegii Gonvillii et Caii Socium honoris causa creatum

HORMASJI JEHANGIR BHABHA

When Lord Rutherford was composing his speech before setting out for India to preside over the meeting there of the British Association, this was the only man whom he found occasion to mention by name; such was his eminence already. His father was an Oxford man. He himself, after education in India, had come to Cambridge, where he studied first engineering and then physics, and was awarded the Isaac Newton Studentship. On his return to his own country, after subtle research, thought and observation on the more recondite laws of nature, he became Professor of Theoretical Physics in the Tata Institute. But he is by no means a scholarly recluse, being at home Director of the same Institute and Chairman of the Indian Atomic Energy Commission, while abroad he is held in such esteem that he was elected Chairman of the International 'Atoms for Peace' conference held recently at Geneva.

But concentration on his studies has never prevented him from finding time for social intercourse and relationships: he is a good linguist, and travels widely; and being himself an exponent of the arts of music and painting, he eagerly seeks the society of such men. Should I add that he is also remembered in his College as cox of the fifth boat?

I present to you

HORMASJI JEHANGIR BHABHA, F.R.S.
Honorary Fellow of Gonville and Caius College

TIFR TODAY: A NATIONAL RESOURCE

In the seventh decade of its existence, TIFR remains a national resource and a symbol of the country's potential. As an internationally renowned research institution, its research encompasses all branches of the natural sciences and mathematics. In addition to basic research, the institute remains conscious of the importance of science education, public outreach, and the training of young researchers. Scientists nurtured at TIFR lead a host of laboratories and institutions of basic research, applied science and technology in India and around the world.

"No organizational chart of the future developments of the Institute was submitted either when it was founded or later. The philosophy has always been to support ability whenever it has been found in the fields of work directly covered by the Institute or in related areas."

– Introduction, Tata Institute of Fundamental Research 1945 – 1970 (Silver Jubilee Commemoration Volume).

Growing Science and Scientific Culture

Bhabha had conceived TIFR not merely as a place for doing excellent science but as an instrument for growing science and scientific culture in India. TIFR catalyzed the formation of several national initiatives in science and technology, such as:

- The Atomic Energy Establishment at Trombay, later renamed the Bhabha Atomic Research Centre, and the atomic energy programme of India
- The National Centre for Software Technology (NCST) in Mumbai and Bangalore, now absorbed by the Centre for Development of Advanced Computing (CDAC). (TIFR designed India's first computer, TIFRAC)
- The Society for Applied Microwave Engineering and Electronic Research (SAMEER) in Mumbai and Chennai
- The Inter-University Centre for Astronomy and Astrophysics (IUCAA, Pune)
- The Centre for the Development of Telematics (CDoT)
- The University of Mumbai -Department of Atomic Energy (UM-DAE) Centre for Excellence in Basic Sciences, Mumbai

A Distributed Institution of Excellence

Research at TIFR is grouped into three major schools : the School of Natural Sciences, the School of Mathematics and the School of Technology and Computer Sciences.

The School of Natural Sciences has seven departments: Biological Sciences, Chemical Sciences, Astronomy and Astrophysics, Condensed Matter Physics and Materials Science, Nuclear and Atomic Physics, High Energy Physics and Theoretical Physics.

TIFR's centres located across the country include:

(a) The Homi Bhabha Centre for Science Education (HBCSE) at Mankhurd, Mumbai, which aims to promote equity and excellence in science and mathematics education from primary school to undergraduate college level, and encourage the growth of scientific literacy in the country.

(b) The National Centre for Radio Astrophysics (NCRA) which is a leading centre for research in a wide range of areas in astronomy and astrophysics.

(c) The National Centre of Biological Sciences (NCBS) in Bengaluru is involved in basic research in the frontier areas of biology, ranging from the study of single molecules to systems biology.

The two new initiatives of TIFR, the International Centre for Theoretical Sciences (ICTS) at Bengaluru and TIFR's new campus at Hyderabad, continue this philosophy of growth.

The TIFR Centre for Applicable Mathematics (TIFR-CAM) is also located in Bengaluru. In addition, TIFR has the following field stations and facilities at various parts of the country:

- The National Balloon Facility at Hyderabad;
- The Giant Metre-Wave Radio Telescope (GMRT) at Khodad near Pune;
- The Cosmic Ray Laboratory at Udhagamandalam, Tamil Nadu;
- a large equatorially mounted cylindrical radio telescope at Udhagamandalam;
- The Gravitation Laboratory at Gauribidnur in Karnataka;
- The High Energy Gamma Ray Laboratories at Pachmarhi (Madhya Pradesh) and Hanle (Ladakh);
- The Pelletron facility at Colaba;
- The National Facility for High Field NMR at Colaba.

From the beginning, research programs at TIFR have involved graduate students centrally. By the end of 1960s, a Graduate School was set up, and TIFR students received a Ph.D degree from Bombay University until 2002, when the institute was declared a deemed university. Students graduating from TIFR are well trained to take up a challenging career in science. The institute cherishes this contribution to the nation.

New Initiatives :

It is a tribute to the vision of its founder that in the birth centenary year of Homi Bhabha, the institute is poised for even greater growth. Two of its most significant new initiatives will take shape during the Bhabha Centenary: the International Centre for Theoretical Sciences (ICTS) of TIFR, and the institute's new campus at Hyderabad. The model of TIFR as a distributed institution of excellence is borne out by these initiatives.

International Centre for Theoretical Sciences of TIFR

The International Centre for Theoretical Sciences (ICTS) of TIFR, which began functioning in 2007, is conceived to contribute to the growth of excellence in the basic sciences. Through its programs, interactions and cross-fertilization between disciplines, it is envisioned to enhance the research ecosystem in India. Its permanent campus in Bengaluru will be near the city's other research institutions, including TIFR's two other centres, NCBS and CAM.

TIFR's New Campus at Hyderabad

TIFR's new campus at Hyderabad, which will shortly come up on a large site close to the University of Hyderabad, will bring in new opportunities, enrich the academic environment, and facilitate collaborative research with the faculty of the University of Hyderabad as well as other research and educational institutions in the region. It will allow the institute to keep intact its essential character, with a wide set of diverse but individually excellent programs, as well as a readiness to embark on new projects both in research and education when necessary.

TIFR today is a distributed institution of excellence living up to the founding vision of Homi Jehangir Bhabha.