

am interested in this fight against TB. When I heard the real purpose of this Institute, it struck me that this was something unique and something far more important than some institute or hospital for treating patients... It is impossible to treat millions of cases by hospitalising them. So you have to adopt some different techniques, some different strategy of approach. Now, when you deal with vast number of people... you cannot do these things in a big way without large scale public cooperation... I welcome this Institute, exactly the kind of thing which vaguely I had thought of without knowing that people who know much more about it, were actually going to do it. Therefore, I welcome it all the more and wish it success"<sup>2</sup>.

After the speeches, the Prime Minister inaugurated the Institute by cutting the tape. With the dignitaries following behind him, he entered the premises of Avalon. He visited every section and met the staff who explained the nature of their functions and duties. The Prime Minister's entourage then left, leaving the day for the

Director and staff to deliberate along with the TB workers.

Mr S Ramaswamy, an officer from the Health Ministry accompanying the entourage reports: *Avalon, surrounded by vast evergreen wore a bridal look. The atmosphere of the assemblage was serene and silent as if in a chapel, just before the prayer. It seemed that the select gathering of doctors, technical people and interested workers in the field had come here to take a new message, digest it and carry it to the masses with the zeal of one who had discovered the truth. **It was not a mela (fair), not a social gathering, not even the opening of a building, but the inauguration of a bold new idea and a radical venture to fight one of the deadliest enemies of the human race***<sup>3</sup>.

## **1.2. In the beginning**

The reference section of NTI library contains a carefully stacked and faded mimeographed prized document, *The Plan Of Operations For The National TB Programme (NTP), India*<sup>4</sup>. This contains exhaustive details of the avowed objectives of

the NTI. If one wants to peep into the beginning, uncertainties creep in. When and where was the NTI born? What necessitated its birth? Who or which agencies endeavoured in formulating its ideology? What made the government set it up? The events are as important as their prime movers. There can be several versions, each as important as its narrator. Therefore, any story narrated will have shortcomings.

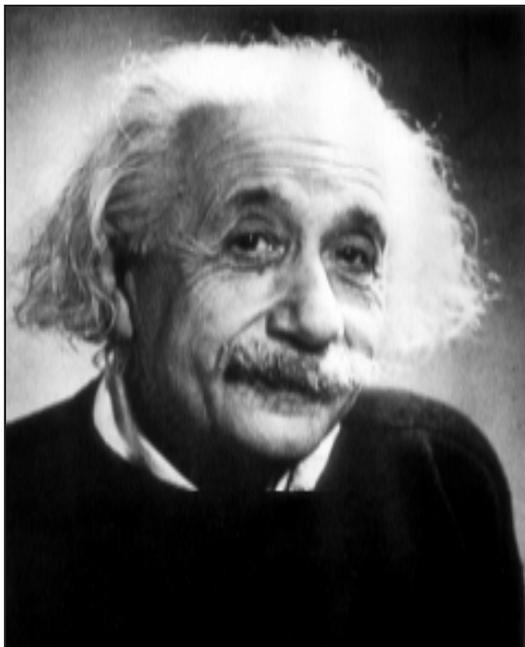
Obviously, the most dominant reason was the TB disease itself. With its long history across the world, as the captain of all the killers, (white plague, consumption, or phthisis) TB was a major killer threatening the Indian subcontinent too. TB was known in India as *kshaya*, *j`rajrog amDam{J* and *yakshma`j\_m*. There are descriptions of a disease closely resembling TB from the Vedic times. The word *kshaya* means literally wasting away, like *consumption*, the name given by John Bunyan of England in the 17th century<sup>5</sup>. Till the middle of the 19th century, the cause was unknown. Hence,

virtually any line of treatment was adopted in our country as elsewhere. Noticing multiple cases of pulmonary TB in households, people began to believe that the disease could be hereditary. The disease was feared as much as the taboos woven around it.

Researchers in Europe were the first to act on progressive lines. Rene Theodore Laennec (1781-1826), the inventor of the stethoscope, who himself suffered from consumption, laid the foundations of the knowledge of the etiology of TB<sup>6</sup>. After a series of experiments, Jean Antonine Villemin (1827-1892) demonstrated in 1868 that TB could be transmitted to rabbits by inoculation of tubercular material from human and bovine sources; the disease could later be passed from animal to animal. He said: "(i) TB is a specific infection; (ii) it is caused by an agent readily inoculable; (iii) inoculation from man to rabbit can be readily performed". Villemin predicted that his work would herald *a new era of research that would lead to the prevention and cure of TB. In effect, TB comes from TB*<sup>7</sup>!



*Dr. Robert Koch  
1843-1910*



*Albert Einstein*

Robert Koch's (1843-1910) first investigations were on the anthrax bacilli. He observed their development from spores by inventing the 'hanging drop' technique. By 1877, he was able to fix smears. He evolved a method for the cultivation of germs on solid media and on coagulated human serum by an astute combination of heat fixing the bacilli to the glass slides and prolonged staining techniques. He, thus, discovered the causative agent of TB. The bacilli appeared brilliant blue and were associated with TB in human and animals<sup>8</sup>.

### **1.2.1. Historic announcement**

On March 24, 1882, Robert Koch read his paper on "Über Tuberkulose", in the Berlin Physiological Society. Here, he announced the discovery of causative organism of TB. His discovery was so great that instead of the customary applause, he received an astounded silence. The silence was, however, short-lived. In that hour Koch introduced a totally new era in the struggle

against TB. Its relevance continues till today. He visited Egypt and India in 1883 as the Head of the German Cholera Commission and discovered the *Cholera Vibrio*. He later studied *Rinderpest* in South Africa, tropical malaria, plague and many other diseases. Finding cure for white plague was his foremost concern. An eager Koch announced it in 1890. It was an extract: i.e., a heat concentrated culture filtrate, on which the tubercle bacilli had been grown. However, these modified tuberculins failed as therapeutic agents and brought him some ill fame. Yet, Koch's school of work inspired many facets of research in prevention, control and therapeutic aspects of the disease. He was awarded the Nobel prize in 1905 and was elected to the German Academy of Sciences<sup>9</sup>.

### **1.2.2. Efforts of non governmental organisations**

Unfortunately, no cure was found for years to come. Therapy implied isolation in sanatoria, artificial pneumothorax (AP) and thoracoplasty. The eventual death

that followed TB, fuelled further taboos. People began to believe that avoidance was the only approach possible. Robert Philip of Scotland (1857-1939) was among the first to recognise that preventive aspects must form an important component of therapy and an *organised effort* was needed to tackle a contagious disease like TB. In 1887, he initiated a well-directed movement. He set up a dispensary for ambulatory care of TB and laid down a standard routine to be followed<sup>10</sup>. Philip's efforts lead to "A national crusade against a national disease" and in 1898, the National Association for the Prevention of TB was born in Edinburgh. In 1900, the Central Bureau for the Campaign Against TB was born in Berlin, which was the forerunner of the International Union Against Tuberculosis (IUAT)<sup>11</sup>.

After the First World War, from 1922, the IUAT started playing a prominent role. As governments alone could not effectively take steps, voluntary agencies began to assume responsibility for providing relief. The movement was more often lead by missionaries.

Country after country followed suit in a systematic campaign of public education calling attention to the dangers of the spread of TB, the precautions necessary for its prevention and the possibilities of treatment<sup>11</sup>.

In India, the first open air sanatorium for treatment and isolation of TB patients was founded in 1906 in Tiluana, near Ajmer, followed by one in Almora after two years. Both were built by Christian Missionaries. In 1909, the first non-missionary sanatorium was built near Shimla. Upon the earlier work done by Dr Louis Hart from 1908, the United Mission Tuberculosis Sanatorium (UMTS) was built in 1912 at Madanapalle, south India. Dr Frimodt Moller became its Medical Superintendent. This institution and Dr Moller played a large role in India's fight against TB through the training of TB workers, conducting TB surveys (1939) and introduction of BCG vaccination (1948). In addition, the first TB dispensary was opened in Bombay in 1917, followed by another in Madras. Soon anti-TB societies were formed in Lucknow

and Ajmer<sup>6</sup>

On behalf of the government, Dr Lankaster conducted a tuberculin survey for several years and published the report in 1921. Due to the high incidence of TB infection, he recommended that the government should work closely with the non-governmental organisations (NGOs) and support their activities. Following this suggestion, India became a member of the IUAT in 1929. At that time, India was a conglomerate of provinces and states ruled by the British. The disease was threatening but funds were scarce. In 1937, Her Excellency Lady Linlithgow issued a public appeal for anti-TB funds on behalf of the government. As a result, nearly a crore of rupees was collected. 5% of this money was retained by the centre and the balance was distributed to the provinces and states. With the help of this 5% direct donation and the King George V Thanksgiving (Anti-TB) Fund, The TB Association of India (TAI) was formed in February, 1939. Her Excellency became the President of the TAI. Dr Frimodt

Moller became its Medical Commissioner and Dr BK Sikand its Secretary. The provinces and states which received money also started their TB associations. The Bengal TB Association, however, had been functioning from 1929, and maintained dispensaries in Calcutta and Howrah. Its activities were strengthened by this funding. Drs AC Ukil and PK Sen were working in Calcutta in the All India Institute of Hygiene and Public Health<sup>12</sup>. In 1946 there were only 6000 beds available for the treatment of TB patients. The Bhore committee<sup>13</sup> estimated that there were about two and a half million patients in need of treatment and half a million deaths annually. For a huge country like India, which included Pakistan and Bangladesh in those days, the sporadic efforts of NGOs were not adequate. The government had to intervene.

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However, the issue of diagnosis, let alone treatment, remained unresolved. The diagnostic methods for TB, even as late as 1920s, were ordinary physical examination without X-rays.

**Wilhelm Conrad Roentgen** (1845-1923) had discovered X-rays by the turn of the century. Yet, it took some time and many innovations, before the chest X-ray became technically adequate. Only by **1925, chest radiology** could detect a deep-seated area of TB consolidation and thoracic surgeons began to demand X-rays. Even then, Mass Miniature Radiography (MMR) remained a dream until the work of **Manoel de Abreu, a Brazilian physician**. In 1936 with his efforts, the **first X-ray apparatus** of relevance in a collective thoracic survey was introduced in a German hospital of Rio de Janeiro. By 1945, the capability of the apparatus was enhanced to embody the MMR version<sup>14</sup>.

As no drug or combination of drugs were effective against TB, the main line of treatment was good food, open air and dry climate. Till the advent of adequate chemotherapy, the treatment took a second place to diagnosis and prognosis. Even great physicians could only advocate vague platitudes like “attention should be paid to the

bowels ..... adequate rest, .... etc". The Proceedings of the 1939 TB Conference was awash with physical examination, clinical observation, X-ray examination as a guide to treatment<sup>15</sup>. In 1939, the TAI recommended the Organised Home Treatment Scheme as the best compromise under the prevailing circumstances: the TB Clinic becomes the hub of all anti-TB activities around which such a limited TB programme works<sup>16</sup>.

Meanwhile, the Second World War broke out. Fighting diseases took a back seat. However, after the War, even though India was being ruled by the British, it is to the credit of the government that they recognised TB as a major problem. They established a **TB Division** in the DGHS in 1946, with the Adviser in TB as its head. TB was also given a prominent place in the planning. Since the government was not only concerned with TB but with other diseases and health infrastructure, it constituted a committee under the chairmanship of Sir Joseph Bhore. Its secretary was Rao Bahadur KCKE Raja, who as the DGHS, played a dominant role in

the TB field during his tenure. Published in 1946, the report presents a harrowing picture. As mentioned earlier there were about half a million deaths from TB and 2.5 million open cases of TB who were continually disseminating infection in the undivided Indian sub-continent. No surveys of sufficient magnitude have yet been undertaken to map out the distribution and intensity of TB infection in the country as a whole. Yet the information available suggests that, the incidence of disease is higher in urban and industrialised areas than in rural regions... existing facilities for an effective campaign .... are altogether meager.... The number of doctors with sufficient experience of TB work to qualify for posts in TB institutions does not probably exceed 70 or 80; fully trained TB health visitors (HVs) are in all probability only about 100... These figures help to indicate magnitude of the task that has to be achieved before satisfactory control can be established over the disease<sup>13</sup>.

The Bhore committee placed



*Rajkumari Amrit Kaur  
President  
Tuberculosis Association of India  
First Union Health Minister of India*

organised domiciliary service at the forefront of the programme. It recommended setting up of a clinic for each district and the use of mobile clinics for rural areas<sup>13</sup>.

BCG vaccine, named after the two scientists who developed it, stands for Bacillus Calmette Guerin. First introduced in 1921 in Paris, BCG vaccinations were administered in most countries in Europe<sup>14</sup>. Every one had pinned high hopes on BCG and the GOI followed suit. The BCG work started in India as a pilot project in two centres in 1948. In 1949, it was extended to schools in almost all states of India. Under the aegis of the International



*Rajkumari Amrit Kaur addressing the BCG Conference in 1952*

Tuberculosis Campaign, which had considerable experience in BCG work in many countries, it was introduced in India on a small scale in Madanapalle with Dr Frimodt Moller in the lead. India started the Mass BCG Campaign in 1951. There was a Central BCG Organisation with one BCG officer, one publicity officer and one statistical officer. A BCG Vaccine Production Centre in Guindy, Madras was set up in 1948. The WHO and UNICEF provided the necessary support. BCG work in India gained momentum<sup>17</sup>.

The next issue was treatment. In the 1930s, sulfanilamide and penicillin came into the pharmacopoeia and revolutionised medical practice. Can drugs be found to combat TB? Fortunately, remedies were discovered rapidly. A breakthrough occurred in 1944 with the discovery of streptomycin (SM) by Dr SA Waksman. In 1946, Jorgen Lehmann found out that para-amino salicylic acid (PAS) had a demonstrable bacteriostatic activity against *M.tuberculosis* (*M.tb*). By 1950, Dr Domagk et al introduced thioacetazone (T)<sup>18</sup>.

The very notion that there can be effective drugs against the tubercle bacilli, was so revolutionary that researchers began to experiment on the effective dosages and combination of drugs to be used. The issue of affordability was also considered<sup>18</sup>. In the 1949 Annual TB Workers Conference, several papers were presented on the effects of PAS and SM on the patients and on the distribution of SM in India<sup>19</sup>. In 1951, Dr BK Sikand, the Director of the New Delhi TB Centre (NDTC) stated succinctly in the paper: *Some observations on the organised home treatment scheme in Delhi*. He focussed on the organised scientific diagnosis, modern scientific treatment and economic relief to patients. He summed up his technique as “BCG syringe in the right hand and AP needle in the left”<sup>20</sup>. In 1952, Dr NN Sen presented a paper in the IX TB workers conference on the use of antibiotics and Dr E Nassau on the determination of sensitivity of the tubercle bacilli to SM and PAS<sup>21</sup>. Although Isoniazid (INH/H) was known to medical researchers from 1920 onwards its use as an

antitubercular drug was established in 1952 by Drs Robitzek and Selikoff who revealed that INH is a miracle drug against TB and it continues as such till date.

In 1953, Frimodt Moller and others presented the paper *The effect of SM and INH, single and combined, in the treatment of pulmonary TB in Indian patients* in the conference. They stated: “*The findings of the present investigation has impressed us by the remarkable results caused by the chemotherapy alone....some cases relapsed after treatment was withdrawn, so it can be concluded that chemotherapy may have to be kept up for more than 9 months*”<sup>22</sup>. There were other studies of importance on treatment efficacy presented in the same conference.

In 1956, Drs Sikand and Pamra presented a paper on the “effect of SM, PAS and INH in 703 cases of pulmonary TB, diagnosed and treated during 1951-53”. They found that the results of domiciliary treatment were encouraging enough to warrant a shift of emphasis from hospitals and sanatoria to clinics without waiting

for any further trials<sup>23</sup>.

These studies would, in time, revolutionise the management of TB all over the world. However, it soon became apparent that the tubercle bacilli could not be destroyed easily even with drugs. They had powerful survival techniques, besides developing resistance to drugs. Trials indicated that the newly available drugs, when used singly, were effective only for short periods. To be effective, treatment should be continued for at least 12-18 months. This brought with it several problems. How many patients will continue to take medicines for such a long duration? How to keep track? Further research was, therefore, needed to harness the potential of these newly discovered drugs<sup>18</sup>.

In the mean time, the government had established in 1956, the Tuberculosis Chemotherapy Centre, later known as Tuberculosis Research Centre (TRC) in Madras (Chennai), under the auspices of the ICMR, Government of Madras, the WHO,

and the British Medical Research Council (BMRC). This Centre was to provide information on the mass domiciliary applications of chemotherapy in the treatment of pulmonary TB. It demonstrated that the time honoured virtues of sanatorium treatment such as bed rest, well-balanced diet and good accommodation were remarkably unimportant provided adequate chemotherapy was prescribed and taken. Further, there was no evidence that close family contacts of patients treated at home, incurred an increased risk of contracting TB<sup>24</sup>. Therefore, it would be appropriate to treat infectious patients in their own homes.

Dr BK Sikand who had conducted several studies on the treatment and its organisational aspects would often stress: one thing is certain that no drug therapy can be employed to optimal advantage without frequent periodic review of the situation. Effective antibiotics have increased, and not lowered the responsibility of a correct diagnosis, especially when the treatment is to be continued for at

least 12-18 months. The patient's willingness to continue treatment for years is in proportion to the physicians conviction that it is necessary and his ability to transfer his belief to the patient<sup>23</sup>.

### **1.2.3. Measurement of TB problem**

Even though India was a forerunner in inducting chemotherapy, paucity of funds was a real issue. The sheer inaccessibility of the vast number of patients posed problems of unmanageable proportions. The belief that TB was more urban oriented and concentrated in industrialised pockets could be well founded but was not proved. Data from tuberculin surveys conducted from 1930 onwards indicated that 75% of the population living in industrialised cities, above the age of 15 years were tuberculin positive. However, in reality such surveys had not been carried out in rural areas. What was the prevalence of infection in rural areas? Soon evidence began to pile up to the contrary by way of mass BCG Campaigns. The tuberculin testing done on a mass scale prior

to BCG vaccination for 27,95,904 persons in 18 different parts of India during 1948-49, yielded some results. Dr Benjamin concluded in 1950, that the tuberculous infection is so widespread that no part of the country is free from it<sup>25</sup>. The subsequent BCG campaigns revealed similar findings. However, this needed to be checked by scientifically conducted surveys. From 1938, surveys were conducted in many parts of India by motivated TB workers, e.g., Dr Benjamin, 1939; Drs PC Ukil and Sahani, 1941; Dr Aspin, 1945; Dr Frimodt Moller, 1949; Drs Sikand and Raj Narain, 1952. However, different workers had their own survey plan, methodology and target group such as police, gurkha regiment and labour units. Each survey yielded valuable information and indicated a very high morbidity (sickness) rate, from 2.3 to 7% of the population studied. These failed to provide adequate information for estimating the incidence of TB in the general population. In 1952, Dr Frimodt Moller conducted a survey in a rural population of 34,000 persons living in 175 villages around Madanapalle, south India.

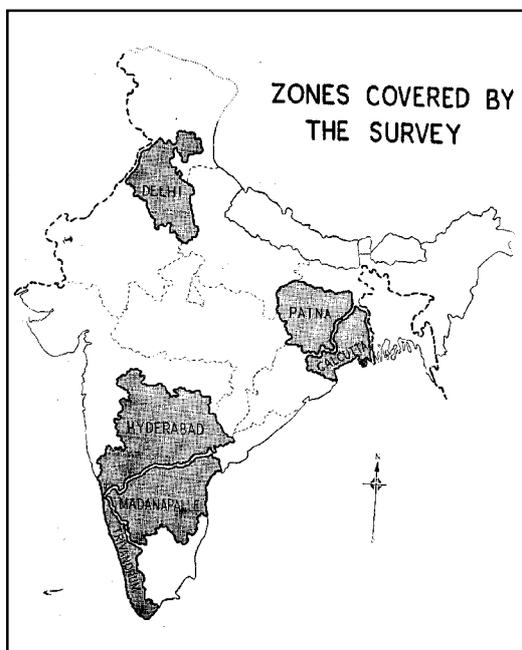
The mortality rate in this group was 0.42% and tubercle bacilli were demonstrated in 0.24 %<sup>26,27</sup>.

#### **1.2.4. Planning of national sample survey**

For a country as large as India, this sample of one area was inadequate. Reliable information on the magnitude and extent of the disease in the various cross sections of the population was required. This was not an easy task. Apart from resources, trained personnel to conduct large scale surveys was not readily available. In the post-independence period, Pandit Jawaharlal Nehru was eminently suited to harness the patriotic fervour as well as available talent in the country. Raj Kumari Amrit Kaur was the Health Minister and KCKE Raja the DGHS followed by Lt Col CK Lakshmanan, and the recently created TB Division was headed by Dr Benjamin. By any standard, this was a rare combination at the helm of affairs of any country. Even UNICEF and the WHO were eager to provide the required support. A special committee of the ICMR

was set up to address the issue of obtaining this information expeditiously and rationally. It decided that a systematic survey on a countrywide basis should be undertaken. There were many obstacles, technical as well as non-technical. However, through the government's efforts all obstacles were removed and the best of people got to work under the auspices of the TB sub-committee of ICMR. The pace was hastened by India's decision to host the International TB Conference (ITC) to be held in New Delhi, early in 1957. Dr Benjamin was to be the

President. Both the central and state governments cooperated in this major effort. Necessary money was procured, essential staff recruited were quickly trained at Madanapalle and New Delhi, where considerable experience of conducting surveys with MMR was already available. A rigorous time schedule was prescribed; and the proposed field work was to be completed in about two years time, i.e., from 1955-57. Seemingly unsurmountable impediments were somehow overcome. Six teams equipped with mobile X-ray units and laboratory facilities started field work as per schedule in six zones. Despite all odds, the field work was completed in two years time. It took one more year to write the report.



NSS Area Map

#### 1.2.5. Findings of national sample survey

After the exhaustive analysis as a special report: *TB in India - A National Sample Survey (NSS) 1955-58* was released by the Minister for Health on 1 May, 1959<sup>28</sup>. Its findings were:

1. Among 1000 persons there were

*2-8 persons bacteriologically positive, i.e., persons in whose sputa TB bacilli were demonstratable.*

- 2. Among 1000 persons, 13-25 showed active or probably active disease, indicating that they were suffering from the moderately advanced disease, requiring treatment.*
- 3. The disease was more or less equally prevalent in cities, towns and villages.*
- 4. The disease prevalence was lower for females than for males, specially in the age group above 35 years.*

The NSS scientifically revealed what was common knowledge for some time. The government could not be complacent. Action on a massive scale was needed. What kind of action? Who should take it? In fact, the problem was so large that no amount of expansion on formal lines viz., more sanatoria, more TB clinics would suffice. The findings of NSS and TRC revealed that the control of TB would require

a totally new approach. The focus should be on the preventive aspects: to find and deal effectively with potential cases. Such work must be done on a community basis, especially in the hitherto neglected rural areas. A National TB Training Centre must be established, to develop the modus operandi of such work and to train personnel who would translate the tasks as envisaged<sup>25</sup>.

The objectives with which the TRC was established were limited in scope and content; despite being important could not be assigned the work of developing a nationally applicable programme. Intense discussions followed. As stated earlier, Dr Mahler and Mr Stig Andersen were already working in India for the BCG Campaign. They had toured the country extensively and had acquired first hand knowledge about the land, the people and their behaviour. Dr Nagpaul had joined the TB Division in the DGHS which had Dr Benjamin as Adviser. There were many supporters like Mr TG Davies of UNICEF and Dr C Mani of the WHO-SEARO. With Dr Benjamin

as the driving force, the government found the necessary support from the WHO and the UNICEF. In 1958, it reached an agreement, most of which is enshrined in the *Plan of Operations*<sup>4</sup>. Work began in earnest for establishing the NTI.

As Dr Nagpaul recalls in 1998: *But why did India need NTI? Sometime in 1954, at Jaipur in Rajasthan, I was called to the office of Dr Kelavkar, Director of Health Services (DHS) to discuss the problem of TB. In his office, I was introduced to Dr Halfdan T Mahler, WHO MO, who had come to introduce the Mass BCG Campaign in Rajasthan. I confessed that my knowledge about BCG was quite academic, my interest in the subject was minimal. As a surgeon, I was already neck deep in setting up thoracic surgery facilities in King George V Sanatorium, where I was the Medical Superintendent. I was advised by Dr Lodha, his Deputy, to accept a position in the TB division because in Rajasthan there was hardly any one who knew anything about BCG in early fifties. Giving up surgery for few months, I spent a lot of time with Dr Mahler in the field to find out that he was not a TB worker but a*

*dynamic public health person. He left behind two public health nurses, one of whom was Ms Moller, a sister of Dr Frimodt Moller of Madanapalle sanatorium, to show me how the campaign was to be organised and supervised. In my last meeting with Dr Mahler at Deeg, he asked me why I had taken so keen an interest in a public health oriented programme when I was a surgeon. I told him about my personal disillusionment with surgery for TB and my plan for organising a network of TB clinics in Rajasthan, if only the state government would let me do so. Perhaps, that message got stuck in Dr Mahler's mind as he returned to Delhi.*

*Early in 1955, I heard from Dr PV Benjamin, asking whether I would be interested in going over to the Centre (GOI) to help organise a network of TB clinics in the country, as recommended by the Bhole Committee. For a couple of years, I had gone round the states looking at how the existing TB clinics were operating, when I was asked to go to West Bengal to report on the care being given to TB patients in the Refugee Camps. Before leaving, Shri Dharam Vira, then Rehabilitation*

Secretary wanted the impression to be checked that a considerable number of the TB patients were actually masquerading as TB patients in order to get additional benefits. I came back completely confused, frustrated and somehow convinced that we were not doing the right things for TB patients. Dr Benjamin listened to my account in silence: He neither endorsed my view nor contradicted me. However, a few months later, I was asked to work with two WHO experts, Dr Mahler and Mr Stig Andersen, a Sociologist, in order to prepare a plan for control of TB and care of TB patients which is more suitable for Indian conditions. At the end of three or four months of continuous application, we came up with a **plan of operations** which could be submitted to the GOI and the WHO as well as the UNICEF for approval and support. The Plan centred around the creation of an institute to provide the required answers.

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### **1.3. The early days**

Dr Benjamin may have been dissatisfied that he could not send national officers to Bangalore to set

up the NTI; or at least somebody with Dr Mahler and Mr Andersen. The latter may have felt that the government was being tardy. In fact, the contrary was true. By the inauguration day, most sections were operational. A tuberculin survey in Bangalore city and surrounding areas was in full swing and the next operational study was being planned. Many new recruits had received field training. A methodology to train key personnel was being evolved. These tasks were not easy.

Further, Avalon was not really built for a TB institute, but for the princely family members to live in. Though the campus was adequate for the present needs of the institute, certain modifications were needed. This was a time consuming process because the architects had to come from Delhi and their plans had to be approved and sanctioned by the government. They commissioned suitable alterations in the main building so that it became more functional, and drew up plans for the conversion of the entire single storied rear block to house the laboratory. This proved