2

Once I settled down at the Schwartz High School, Ramanathapuram, the enthusiastic fifteen-year-old within me re-emerged. My teacher, Iyadurai Solomon, was an ideal guide for an eager young mind that was yet uncertain of the possibilities and alternatives that lay before it. He made his students feel very comfortable in class with his warm and open-minded attitude. He used to say that a good student could learn more from a bad teacher than a poor student from even a skilled teacher.

During my stay at Ramanathapuram, my relationship with him grew beyond that of teacher and pupil. In his company, I learnt that one could exercise enormous influence over the events of one's own life. Iyadurai Solomon used to say, "To succeed in life and achieve results, you must understand and master three mighty forces— desire, belief, and expectation." Iyadurai Solomon, who later became a Reverend, taught me that before anything I wanted could happen, I had to desire it intensely and be absolutely certain it would happen. To take an example from my own life, I had been fascinated by the mysteries of the sky and the flight of birds from early childhood. I used to watch cranes and seagulls soar into flight and longed to fly. Simple, provincial boy though I was, I was convinced that one day I, too, would soar up into the skies. Indeed, I was the first child from Rameswaram to fly.

Iyadurai Solomon was a great teacher because he instilled in all the children a sense of their own worth. Solomon raised my self-esteem to

a high point and convinced me, the son of parents who had not had the benefits of education, that I too could aspire to become whatever I wished. "With faith, you can change your destiny," he would say.

One day, when I was in the fourth form, my mathematics teacher, Ramakrishna Iyer, was teaching another class. Inadvertently, I wandered into that classroom and in the manner of an old-fashioned despot, Ramakrishna Iyer caught me by the neck and caned me in front of the whole class. Many months later, when I scored full marks in mathematics, he narrated the incident to the entire school at morning assembly. "Whomsoever I cane becomes a great man! Take my word, this boy is going to bring glory to his school and to his teachers." His praise quite made up for the earlier humiliation!

By the time I completed my education at Schwartz, I was a self-confident boy determined to succeed. The decision to go in for further education was taken without a second thought. To us, in those days, the awareness of the possibilities for a professional education did not exist; higher education simply meant going to college. The nearest college was at Tiruchchirappalli, spelled Trichinopoly those days, and called Trichi for short.

In 1950, I arrived at St. Joseph's College, Trichi, to study for the Intermediate examination. I was not a bright student in terms of examination grades but, thanks to my two buddies back in Rameswaram, I had acquired a practical bent of mind.

Whenever I returned to Rameswaram from Schwartz, my elder brother Mustafa Kamal, who ran a provision store on the railway station road, would call me in to give him a little help and then vanish for hours together leaving the shop in my charge. I sold oil, onions, rice and everything else. The fastest moving items, I found, were cigarettes and bidis. I used to wonder what made poor people smoke away their hard-earned money. When spared by Mustafa, I would be put in charge of his kiosk by my younger brother, Kasim Mohammed. There I sold novelties made of seashells.

At St. Joseph's, I was lucky to find a teacher like the Rev. Father TN Sequeira. He taught us English and was also our hostel warden. We

were about a hundred boys living in the three-storeyed hostel building. Rev. Father used to visit each boy every night with a Bible in his hand. His energy and patience was amazing. He was a very considerate person who took care of even the most minute requirements of his students. On Deepavali, on his instructions, the Brother in charge of the hostel and the mess volunteers would visit each room and distribute good gingelly oil for the ritual bath.

I stayed on the St. Joseph's campus for four years and shared my room with two others. One was an orthodox Iyengar from Srirangam and the other a Syrian Christian from Kerala. The three of us had a wonderful time together. When I was made secretary of the vegetarian mess during my third year in the hostel, we invited the Rector, Rev. Father Kalathil, over for lunch one Sunday. Our menu included the choicest preparations from our diverse backgrounds. The result was rather unexpected, but Rev. Father was lavish in his praise of our efforts. We enjoyed every moment with Rev. Father Kalathil, who participated in our unsophisticated conversation with childlike enthusiasm. It was a memorable event for us all.

My teachers at St. Joseph were the true followers of Kanchi Paramacharya, who evoked people to "enjoy the action of giving". The vivid memory of our mathematics teachers, Prof. Thothathri Iyengar and Prof. Suryanarayana Sastry, walking together on the campus inspires me to this day.

When I was in the final year at St. Joseph's, I acquired a taste for English literature. I began to read the great classics, Tolstoy, Scott and Hardy being special favourites despite their exotic settings, and then I moved on to some works in Philosophy. It was around this time that I developed a great interest in Physics.

The lessons on subatomic physics at St. Joseph's by my physics teachers, Prof. Chinna Durai and Prof. Krishnamurthy, introduced me to the concept of the half-life period and matters related to the radioactive decay of substances. Sivasubramania Iyer, my science teacher at Rameswaram, had never taught me that most subatomic particles are unstable and that they disintegrate after a certain time into other particles. All this I was learning for the first time. But when he taught me to strive

with diligence because decay is inherent in all compounded things, was he not talking of the same thing? I wonder why some people tend to see science as something which takes man away from God. As I look at it, the path of science can always wind through the heart. For me, science has always been the path to spiritual enrichment and self-realisation.

Even the rational thought-matrices of science have been home to fairy tales. I am an avid reader of books on cosmology and enjoy reading about celestial bodies. Many friends, while asking me questions related to space flights, sometimes slip into astrology. Quite honestly, I have never really understood the reason behind the great importance attached by people to the faraway planets in our solar system. As an art, I have nothing against astrology, but if it seeks acceptance under the guise of science, I reject it. I do not know how these myths evolved about planets, star constellations, and even satellites—that they can exercise power on human beings. The highly complicated calculations manipulated around the precise movements of celestial bodies, to derive highly subjective conclusions appear illogical to me. As I see it, the Earth is the most powerful and energetic planet. As John Milton puts it so beautifully in Paradise Lost, Book VIII:

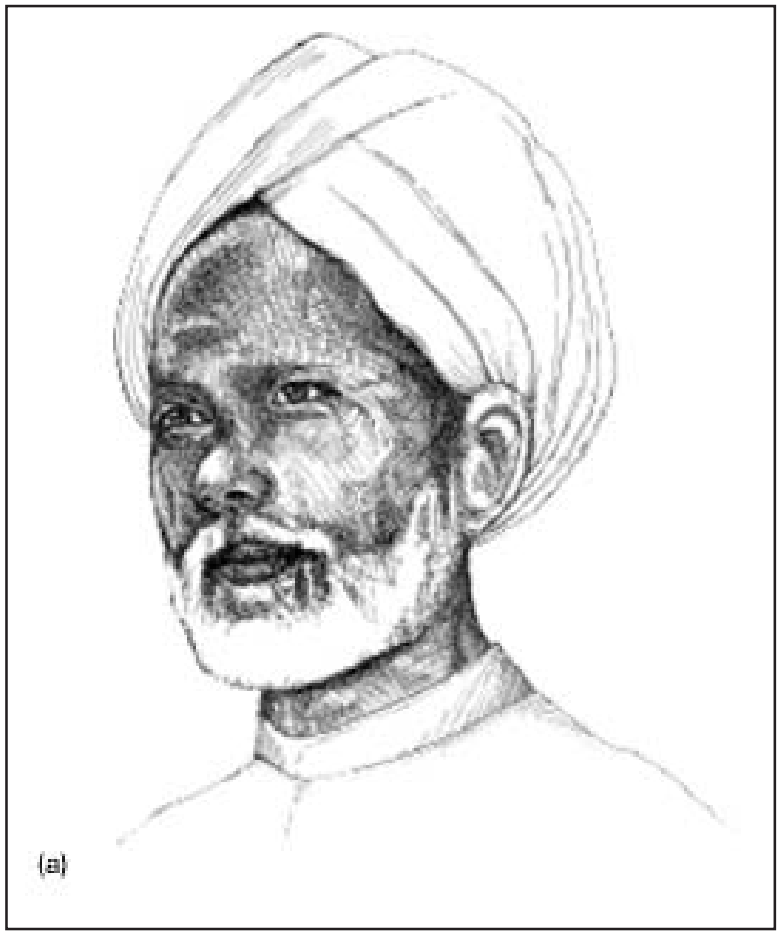
. . . What if the Sun
Be centre to the World, and other stars . . . . .
The planet earth, so steadfast though she seem,
In sensibly three different motions move?

Wherever you go on this planet, there is movement and life. Even apparently inanimate things like rocks, metal, timber, clay are full of intrinsic movement—with electrons dancing around each nucleus. This motion originates in their response to the confinement imposed on them by the nucleus, by means of electric forces which try to hold them as close as possible. Electrons, just like any individual with a certain amount of energy, detest confinement. The tighter the electrons are held by the nucleus, the higher their orbital velocity will be: in fact, the confinement of electrons in an atom results in enormous velocities of about 1000 km per second! These high velocities make the atom appear a rigid sphere, just as a fast-moving fan appears like a disc. It is very difficult to compress atoms more strongly—thus giving matter its familiar solid aspect. Everything solid, thus, contains much empty space within and everything stationary contains great movement within. It is as though the great dance of Shiva is being performed on earth during every moment of our existence.

When I joined the B.Sc. degree course at St.Joseph's, I was unaware of any other option for higher education. Nor did I have any information about career opportunities available to a student of science. Only after obtaining a B.Sc. did I realise that physics was not my subject. I had to go into engineering to realise my dreams. I could have joined the Engineering course long ago, right after finishing my Intermediate course. Better late than never, I told myself as I made the detour, applying for admission into the Madras Institute of Technology (MIT), regarded as the crown jewel of technical education in South India at that time.

I managed to be on the list of selected candidates, but admission to this prestigious institution was an expensive affair. Around a thousand rupees was required, and my father could not spare that much money. At that time, my sister, Zohara, stood behind me, mortgaging her gold bangles and chain. I was deeply touched by her determination to see me educated and by her faith in my abilities. I vowed to release her bangles from mortgage with my own earnings. The only way before me to earn money at that point of time was to study hard and get a scholarship. I went ahead at full steam.

What fascinated me most at MIT was the sight of two decommissioned aircraft displayed there for the demonstration of the various subsystems of flying machines. I felt a strange attraction towards them, and would sit near them long after other students had gone back to the hostel, admiring man's will to fly free in the sky, like a bird. After completing my first year, when I had to opt for a specific branch, I almost spontaneously chose aeronautical engineering. The goal was very clear in my mind now; I was going to fly aircraft. I was convinced of this, despite being aware of my lack of assertiveness, which probably came about because of my humble background. Around this time, I made special efforts to try and communicate with different kinds of people. There were setbacks, disappointments and distractions, but my father's inspiring words anchored me in those periods of nebulous drift.



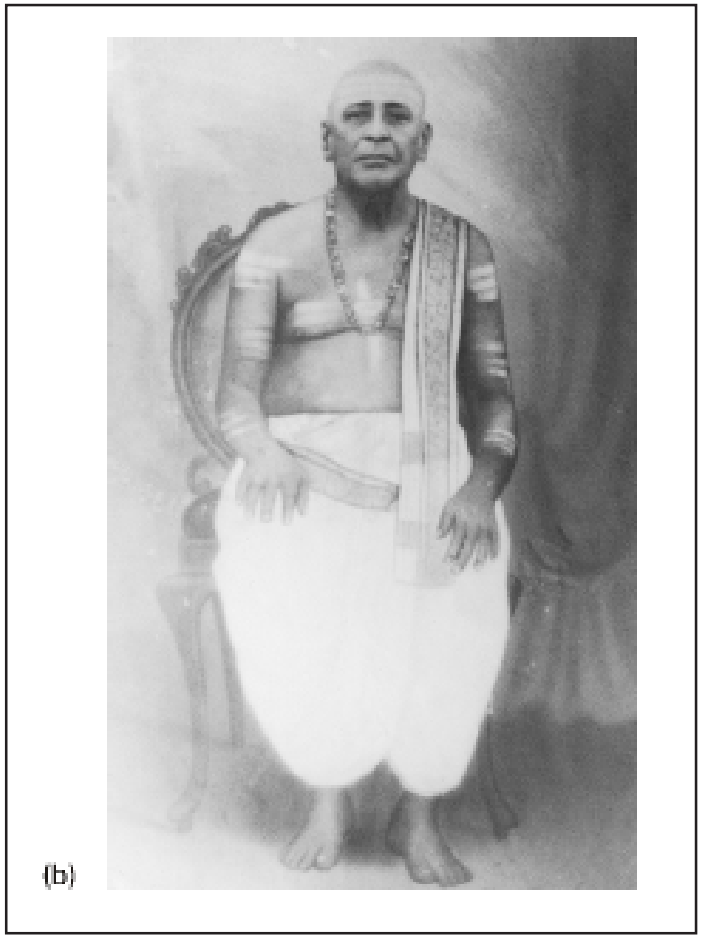


Plate 1 (a) My father Jainulabdeen was not formally educated, but was a man of great wisdom and kindness. (b) Pakshi Lakshmana Sastry, a close friend of my father and the head priest of the Rameswaram Temple.

(a)

(b)

Plate 2 The locality in which I grew up: (a) My house on Mosque Street. (b) Thousands of pilgrims from great distances descend on the ancient temple of Lord Shiva. I often assisted my brother Kasim Mohamed in his shop selling artifacts on this street.

Plate 3 The old mosque in our locality where my father would take me and my brothers every evening to offer prayers.

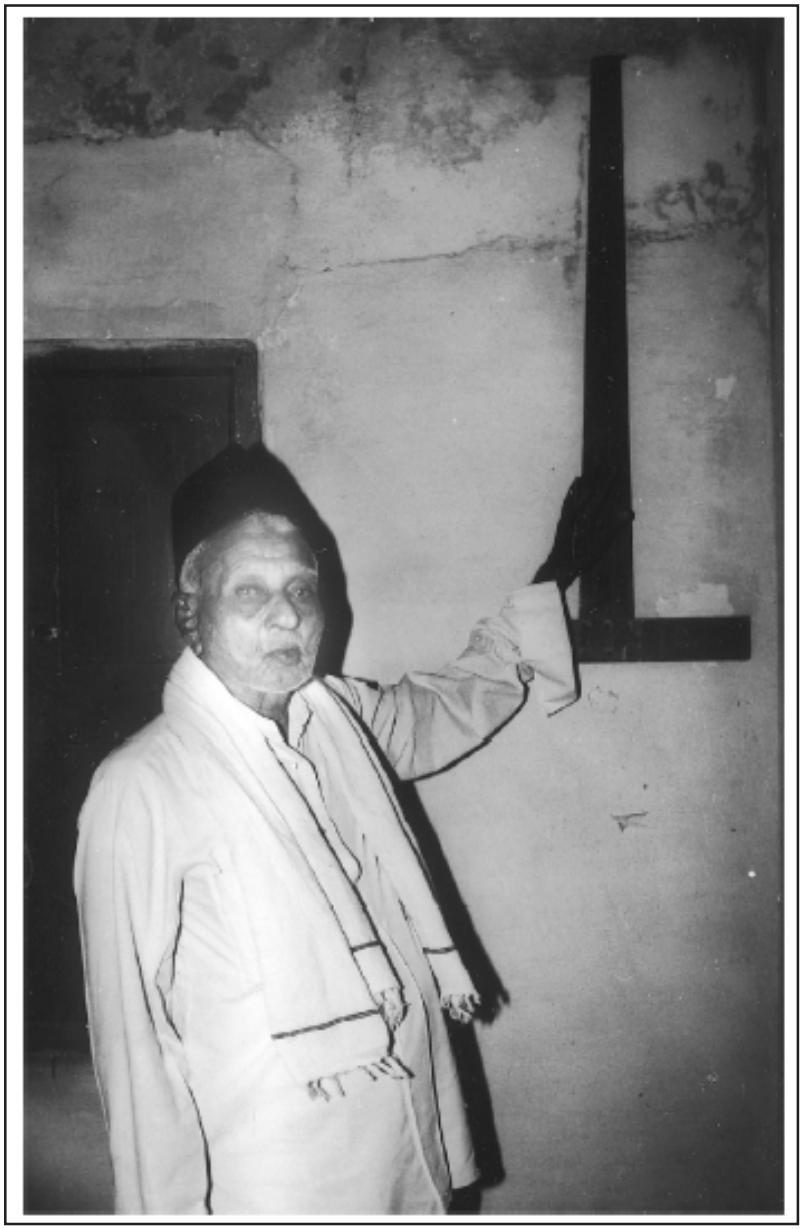


Plate 4 My brother pointing at the T–square I used while studying engineering.

Plate 5 STR Manickam (inset), a friend of my brother Mustafa Kamal, had a large collection of books. This is his house, from where I would borrow books while at Rameswaram.

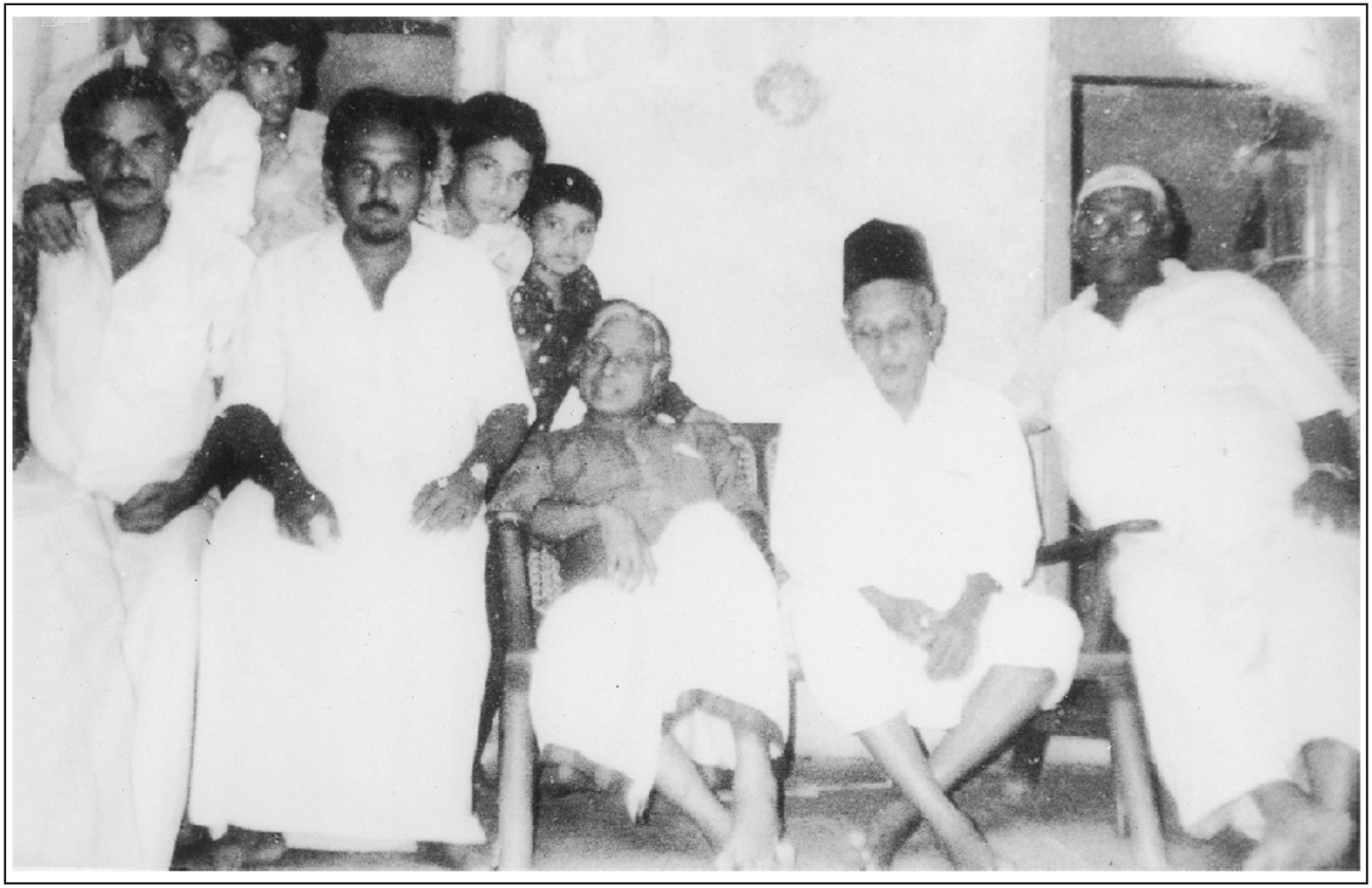


Plate 6 A family get-together.

Plate 7 The simple surroundings of Schwartz High School, Ramanathapuram. The words on the plaque read "Let not thy winged days be spent in vain. When once gone no gold can buy them back again."

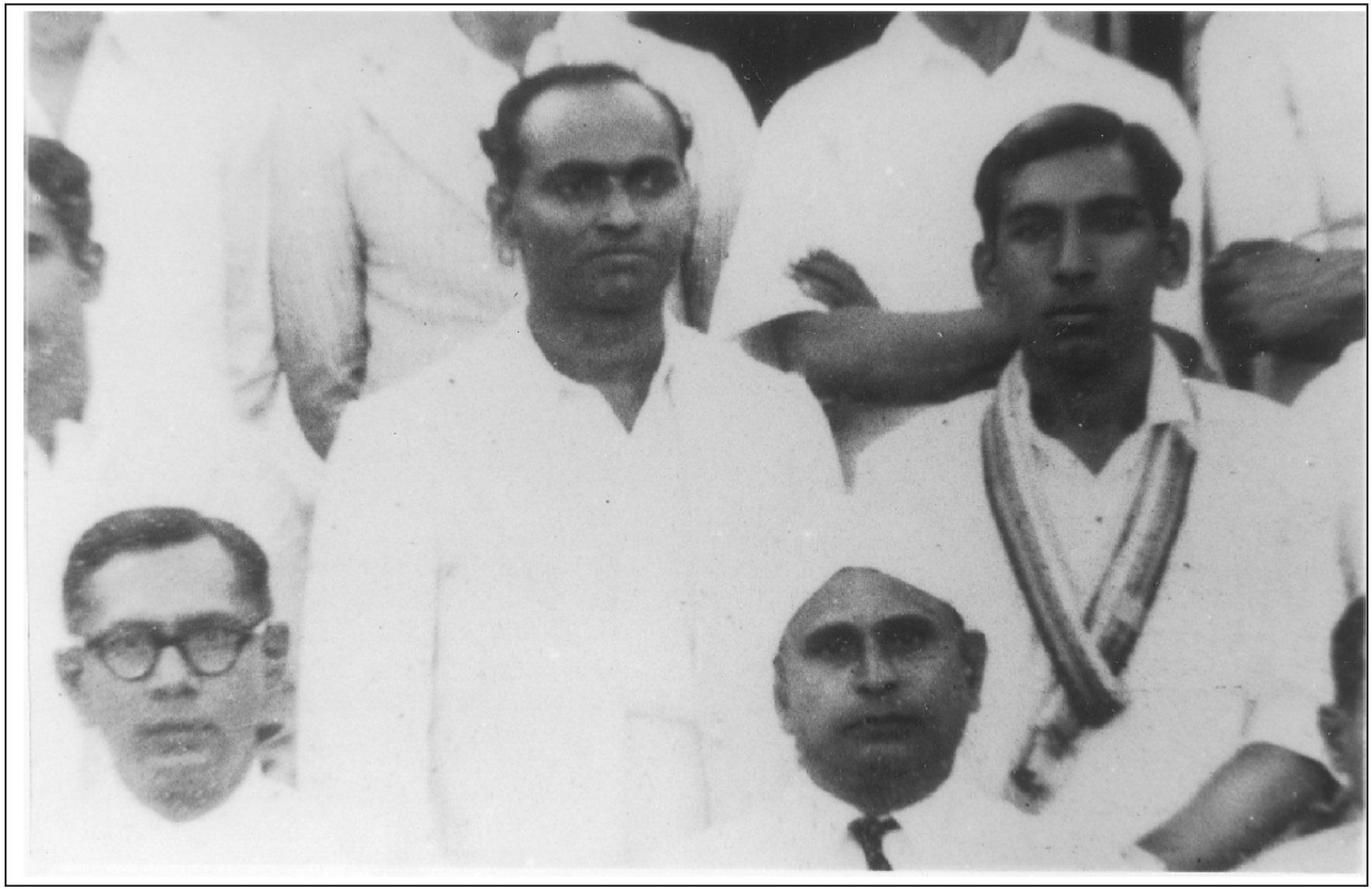


Plate 8 My teachers at Schwartz High School—Iyadurai Solomon (standing, left) and Ramakrishna Iyer (sitting, right). They are the best examples of small-town Indian teachers committed to nurturing talent.

"He who knows others is learned, but the wise one is the one who knows himself. Learning without wisdom is of no use."

In the course of my education at MIT, three teachers shaped my thinking. Their combined contributions formed the foundation on which I later built my professional career. These three teachers were Prof. Sponder, Prof. KAV Pandalai and Prof. Narasingha Rao. Each one of them had very distinct personalities, but they shared a common impulse—the capacity to feed their students' intellectual hunger by sheer brilliance and untiring zeal.

Prof. Sponder taught me technical aerodynamics. He was an Austrian with rich practical experience in aeronautical engineering. During the Second World War, he had been captured by the Nazis and imprisoned in a concentration camp. Understandably, he had developed a very strong dislike for Germans. Inciden- tally, the aeronautical department was headed by a German, Prof. Walter Repenthin. Another well-known professor, Dr Kurt Tank, was a distinguished aeronautical engineer who had designed the German Focke–Wulf FW 190 single-seater fighter plane, an outstanding combat aircraft of the Second World War. Dr Tank later joined the Hindustan Aeronautics Limited (HAL) in Bangalore and was responsible for the design of India's first jet fighter, the HF-24 Marut.

Notwithstanding these irritants, Prof. Sponder preserved his individuality and maintained high professional standards. He was always calm, energetic and in total control of himself. He kept abreast of the latest technologies and expected his students to do the same. I consulted him before opting for aeronautical engineering. He told me that one should never worry about one's future prospects: instead, it was more important to lay sound foundations, to have sufficient enthusiasm and an accompanying passion for one's chosen field of study. The trouble with Indians, Prof. Sponder used to observe, was not that they lacked educational opportunities or industrial infrastructure—the trouble was in their failure to discriminate between disciplines and to rationalise their choices. Why aeronautics? Why not electrical engineering? Why not mechanical engineering? I myself would like to tell all novitiate engineering students that when they choose their specialization, the essential point to consider is whether the choice articulates their inner feelings and aspirations.

Prof. KAV Pandalai taught me aero-structure design and analysis. He was a cheerful, friendly and enthusiastic teacher, who brought a fresh approach to every year's teaching course. It was Professor Pandalai who opened up the secrets of structural engineering to us. Even today I believe that everyone who has been taught by Prof. Pandalai would agree that he was a man of great intellectual integrity and scholarship—but with no trace of arrogance. His students were free to disagree with him on several points in the classroom.

Prof. Narasingha Rao was a mathematician, who taught us theoretical aerodynamics. I still remember his method of teaching fluid dynamics. After attending his classes, I began to prefer mathematical physics to any other subject. Often, I have been told I carry a "surgical knife" to aeronautical design reviews. If it had not been for Prof. Rao's kind and persistent advice on picking up proofs to equations of aerodynamic flow, I would not have acquired this metaphorical tool.

Aeronautics is a fascinating subject, containing within it the promise of freedom. The great difference between freedom and escape, between motion and movement, between slide and flow are the secrets of this science. My teachers revealed these truths to me. Through their meticulous teaching, they created within me an excitement about aeronautics. Their intellectual fervour, clarity of thought and passion for perfection helped me to launch into a serious study of fluid dynamics-modes of compressible medium motion, development of shock waves and shock, induced flow separation at increasing speeds, shock stall and shock-wave drag.

Slowly, a great amalgamation of information took place in my mind. The structural features of aeroplanes began to gain new meanings—biplanes, monoplanes, tailless planes, canard configured planes, delta-wing planes, all these began to assume increasing significance for me. The three teachers, all of them authorities in their different fields, helped me to mould a composite knowledge.

My third and last year at MIT was a year of transition and was to have a great impact on my later life. In those days, a new climate of political enlightenment and industrial effort was sweeping across the country. I had to test my belief in God and see if it could fit into the matrix of scientific thinking. The accepted view was that a belief in scientific methods was the only valid approach to knowledge. If so, I wondered, was matter alone the ultimate reality and were spiritual phenomena but a manifestation of matter? Were all ethical values relative, and was sensory perception the only source of knowledge and truth? I wondered about these issues, attempting to sort out the vexing question of "scientific temper" and my own spiritual interests. The value system in which I had been nurtured was profoundly religious. I had been taught that true reality lay beyond the material world in the spiritual realm, and that knowledge could be obtained only through inner experience.

Meanwhile, when I had finished my course work, I was assigned a project to design a low-level attack aircraft together with four other colleagues. I had taken up the responsibility of preparing and drawing the aerodynamic design. My team mates distributed among themselves the tasks of designing the propulsion, structure, control and instrumentation of the aircraft. One day, my design teacher, Prof. Srinivasan, then the Director of the MIT, reviewed my progress and declared it dismal and disappointing. I offered a dozen excuses for the delay, but none of them impressed Prof. Srinivasan. I finally pleaded for a month's time to complete the task. The Professor looked at me for some time and said, "Look, young man, today is Friday afternoon. I give you three days' time. If by Monday morning I don't get the configuration drawing, your scholarship will be stopped." I was dumbstruck. The scholarship was my lifeline and I would be quite helpless if it was withdrawn. I could see no other way out but to finish the task as I had been instructed. That night, I remained at the drawing board, skipping dinner. Next morning, I took only an hour's break to freshen up and eat a little food. On Sunday morning, I was very near completion, when suddenly I felt someone else's presence in the room. Prof. Srinivasan was watching me from a distance. Coming straight from the gymkhana, he was still in his tennis outfit and had dropped in to see my progress. After examining my work, Prof. Srinivasan hugged me affectionately and patted my back in appreciation. He said, "I knew I was putting you under stress and asking you to meet an impossible deadline. I never expected you to perform so well."

During the rest of the period of the project, I participated in an essay competition organized by the MIT Tamil Sangam (Literary Society). Tamil is my mother tongue and I am proud of its origins, which have been traced back to Sage Agastya in the pre-Ramayana period; its literature dates back to the fifth century BC. It is said to be a language moulded by lawyers and grammarians and is internationally acclaimed for its clear-cut logic. I was very enthusiastic about ensuring that science did not remain outside the purview of this wonderful language. I wrote an article entitled "Let Us Make Our Own Aircraft" in Tamil. The article evoked much interest and I won the competition, taking the first prize from 'Devan', the editor of the popular Tamil weekly, Ananda Vikatan.

My most touching memory of MIT is related to Prof. Sponder. We were posing for a group photograph as part of a farewell ritual. All the graduating students had lined up in three rows with the professors seated in the front. Suddenly, Prof. Sponder got up and looked for me. I was standing in the third row. "Come and sit with me in the front," he said. I was taken aback by Prof. Sponder's invitation. "You are my best student and hard work will help you bring a great name for your teachers in future." Embarrassed by the praise but honoured by the recognition, I sat with Prof. Sponder for the photograph. "Let God be your hope, your stay, your guide and provide the lantern for your feet in your journey into the future," said the introverted genius, bidding me adieu.

From MIT, I went to Hindustan Aeronautics Limited (HAL) at Bangalore as a trainee. There I worked on engine overhauling as part of a team. Hands-on work on aircraft engine overhauling was very educative. When a principle learnt in the classroom is borne out by practical experience, it creates a strange sense of excitement—akin to unexpectedly running into an old friend among a crowd of strangers. At HAL, I worked on the overhauling of both piston and turbine engines. The hazy concepts of gas dynamics and diffusion processes in the working principle of after burning came into sharper focus in my mind. I was also trained in radial engine-cum-drum operations.

I learned how to check a crankshaft for wear and tear, and a connecting rod and crankshaft for twist. I did calibrations of a fixed-pitch fan fitted to a super-charged engine. I opened up pressure and acceleration-cum-speed control systems, and air starter supply systems of turbo-engines. Getting to understand feathering, un-feathering and reversing of propeller engines was very interesting. The demonstration of the delicate art of beta (blade angle control) by HAL technicians still lingers in my memory. They had neither studied in major universities, nor were they merely implementing what their engineer-in-charge was suggesting. They had been working hands-on for years and this had given them something like an intuitive feel for the work.

Two alternative opportunities for employment, both close to my long-standing dream of flying, presented themselves before me when I came out of HAL as a graduate aeronautical engineer. One was a career in the Air Force and another was a job at the Directorate of Technical Development and Production, DTD&P(Air), at the Ministry of Defence. I applied for both. The interview calls arrived from both the places almost simultaneously. I was asked to reach Dehra Dun by the Air Force recruitment authorities and Delhi by DTD&P(Air). The boy from the Coromandel Coast took a train to the North of India. My destination was more than 2000 km away, and was to be my first encounter with the vastness of my motherland.

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3

Through the window of the compartment, I watched the countryside slip past. From a distance, the men in the fields in their white dhotis and turbans, and the womenfolk in bright splashes of colour against the green background of paddy fields, seemed to inhabit some beautiful painting. I sat glued to the window. Almost everywhere, people were engaged in some activity which had a rhythm and tranquillity about it—men driving cattle, women fetching water from streams. Occasionally, a child would appear and wave at the train.

It is astonishing how the landscape changes as one moves northwards. The rich and fertile plains of the river Ganga and its numerous tributaries have invited invasion, turmoil, and change. Around 1500 BC, fair-skinned Aryans swept in through the mountain passes from the far north-west. The tenth century brought Muslims, who later mingled with the local people and became an integral part of this country. One empire gave way to another. Religious conquests continued. All this time, the part of India south of the Tropic of Cancer remained largely untouched, safe behind the shield of the Vindhya and Satpura mountain ranges. The Narmada, Tapti, Mahanadi, Godavari, and Krishna rivers had woven a net of almost unassailable protection for the tapering Indian peninsula. To bring me to Delhi, my train had crossed all these geographical impediments through the power of scientific advancement.

I halted for a week in Delhi, the city of the great Sufi Saint Hazrat Nizamuddin, and appeared for the interview at DTD&P(Air). I did well at the interview. The questions were of a routine nature, and did not