Reminiscences

On the occasion of 90th Birth Anniversary
of

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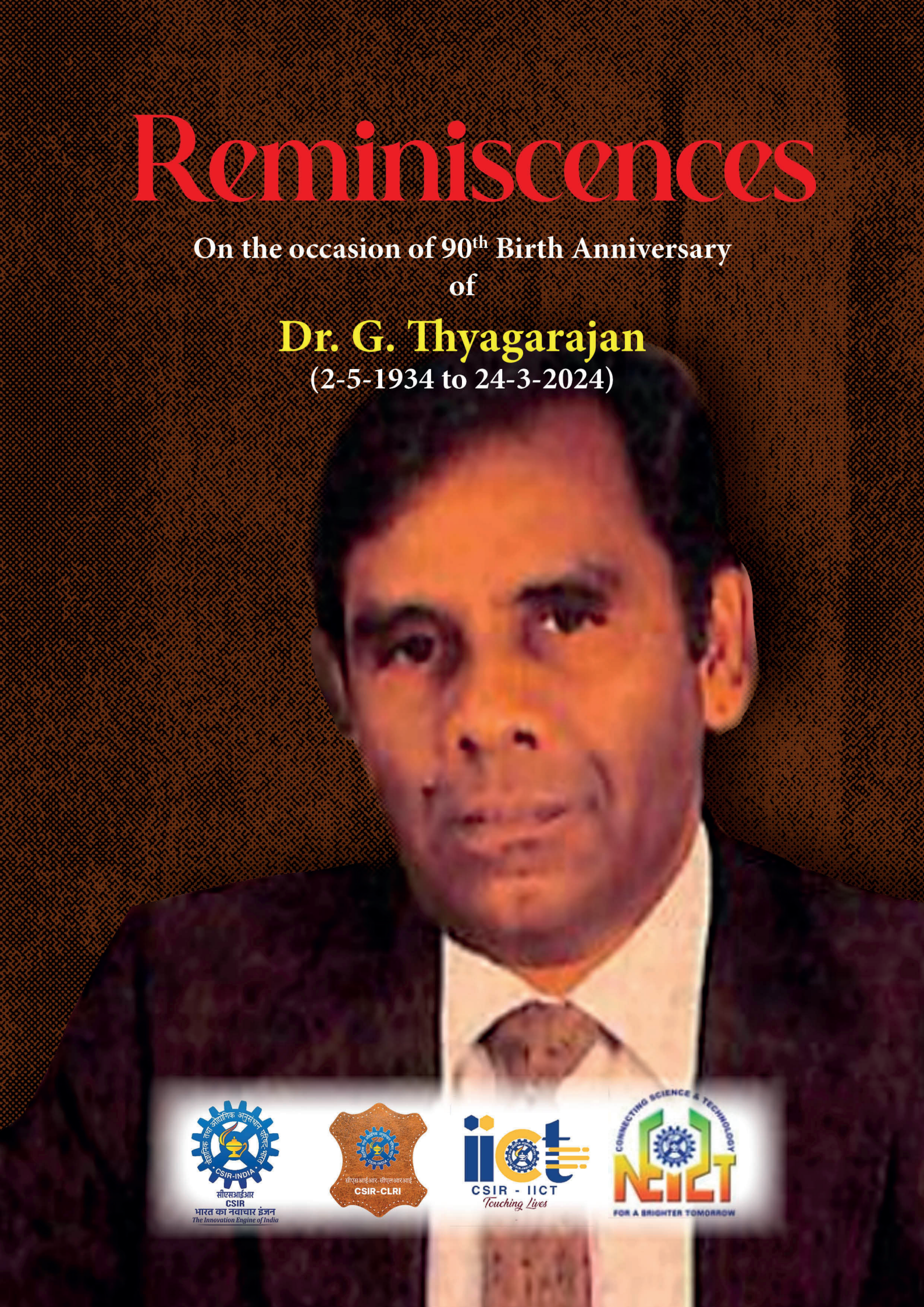
(2-5-1934 to 24-3-2024)



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On the occasion of 90th Birth Anniversary of

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CSIR- Central Leather Research Institute
CSIR-Indian Institute of Chemical Technology
CSIR-North East Institute of Science and Technology

Commemorative Tribute

It was such a joy to see this wonderful `Reminiscences' book (GT@90). This is a remarkable compilation of tributes by the friends and admirers of a remarkable leader, Gopalakrishna Thyagarajan, whom I would rate as being among the foremost builders of CSIR.

Multiple dimensions of GT's personality have been covered in these heartfelt tributes. And there is a common thread amongst what everyone has said – GT as a great thought and action leader, as a bold visionary, and above all, a very fine human being, with an unusual combination of innovation, compassion and passion.

Being appointed as the youngest director (after Dr. Y. Nayudamma) of a CSIR laboratory, the only one to head 3 CSIR laboratories, and more importantly, as one who provided transformative leadership to these laboratories – all this is something that we all know about. But here is something that he is not given enough credit for.

When it comes to India's green revolution, CSIR rarely gets a credit. But would the green revolution have taken place but for the availability of agrochemicals? And especially at a time, when India neither had the foreign exchange to import these agrochemicals nor had an access to technology. The simple answer is that it would not have been possible.

It was CSIR that indigenously developed 70% of the agrochemicals that were used in green revolution. And it was GT, who was singularly responsible for galvanising all the chemical research based CSIR laboratories to lead this national mission, on now what they will call as Atmanirbhar Bharat in agrochemicals with Atmavishwas.

GT has been often described as a Go-To man, who can be trusted in dealing with any challenging problem. The reminiscences of GT by several contributors in this book give several instances of this. But let me share my own personal experiences.

I was the DG of CSIR during 1995-2006. GT for me was the Go-To Man. Let me give some instances.

As a DG, I relied heavily on GT, who was a quintessential CSIR man. Even after his retirement, GT continued to serve CSIR in various forms. For example, he chaired the Research Advisory Councils of CFTRI, NISCOM and so on and was always available, when I sought his guidance.

The CSIR transformation process in 1990s has been ranked as being among the top ten achievements of Indian science and technology in the 20th century by Prof Jayant Narlikar in his book 'Scientific Edge'. Converging CSIR complimentary core competencies in its labs was one of the components in this transformation process.

The Performance Appraisal Board in 2001 had expressed its concern at the under-utilisation of resources available at several CSIR laboratories. So we had undertaken an exercise to network institutes having similar expertise to take up common projects and work together in a 'Team CSIR' fashion. Similarly, it had been decided to merge institutes situated in close proximity and with related competencies.

As a result of this exercise, it was decided to merge two CSIR laboratories, namely CFRI and CMRI. I turned to GT as our Go-To man and requested him to Chair a high powered committee to give us a vision and roadmap for a smooth transition by taking everyone on board. With his deep insights, with his superb gift of communication and amazing convening power, he was able to draw a roadmap, which was acceptable to all. And thus was born CIMFR.

I remember there was a challenge on pesticide residues in beverages in 2003. When the controversy broke up, Mr. Sharad Pawar, who was then the agriculture minister, asked me to make a presentation to the MPs from different parties. V Prakash was then the Director of CFTRI. He helped me make the presentation. And later on, CSIR's help was sought in giving technical inputs leading to a policy on dealing with the challenges of pesticide residues in soft drinks, fruit juices and other beverages. A technical committee had to be formed.

The nation turned to GT again as a Go-To man to chair the technical committee. He held around 40 meetings with parliamentarians, industry, R&D laboratories, NGOs. He worked relentlessly for three months. And then emerged FSSAI (Food Safety and Standards Authority of India) and a robust regulatory framework for water quality, which has served the nation well ever since.

GT was indeed Go-To Man even in the case of national disasters. When Bhopal gas tragedy took place in 1984, Dr S Varadarajan called some of us to help, not only in terms of working out the strategy on neutralising the remaining MIC in the second storage tank in the plant, but also in doing an enquiry into the cause of the accident. GT and I were part of that team.

I (then in NCL) and Dr Sivaram (then at IPCL), were appointed as the technical assessors for the one-man enquiry commission appointed by the Madhya Pradesh government.

There was a painstaking work of analytical and modelling/ simulation work that had to be done. I remember GT giving us huge guidance and support in producing the final evidence and scientific analysis based report.

But as was his wont, GT went an extra mile. There were a lot of lessons that were learnt after the Bhopal gas tragedy about industrial safety. Although it was not CLRI's mandate, which GT was heading at the time, he created a `Cell for Industrial Safety and Risk Assessment' in CLRI. It served the nation well.

Dr Ramasami used to interpret GT as a man with Golden Touch. And he should know. Because he was part of the team, when GT led the transformation of CLRI into a world class leather research laboratory with some of the strongest industry partnerships in our CSIR system with a great emphasis on global competitiveness and environmental sustainability at the same time, what is nowadays referred to as Green Growth.

But the initials GT also meant to me a Global Trailblazer. GT's leadership transcended Indian borders. As a Scientific Advisor to the Secretary General of Commonwealth Secretariat in London, he injected a new life in this organisation, just as he did for COSTED. And CSIR benefited too because of GT's position of global leadership.

His vision helped create the Centre for Metrology Analysis of Commonwealth Science Council in NPL. It helped create CORE (Caribbean Ocean Research Expedition) programme at NIO.

As a global leader, GT truly exemplified the trio of expansion, inclusion and excellence. His concern about small nations was remarkable. He noted that there were 135 independent small nations out of which 45 were island nations with a population of 10 million or less. All of them needed a helping hand on science and technology. I remember participating in the meet that he had organised in February 1998 to deal with the critical subject of technology needs of small nations.

GT was an inspiring leader. He always used to say that we are all solo players. We need to play an orchestra as Team CSIR.

On 11 May 1998, in the CSIR directors' meet in Bangalore, all the 40 CSIR directors signed the Bangalore declaration of `Team CSIR'. It said "India matters to us. We want to matter to India, more". I remember receiving a very affectionate call from GT that Team CSIR was always his dream. And he felt so happy that his dream was coming true now.

GT understood the nuances of human behaviour and social groups like very few did. He chaired numerous committees. In his role of a chairman, he was always firm yet compassionate and he was formal yet collegiate. He strongly believed that Indian science must solve, technology must transform and innovation must impact. And he achieved all this in his lifetime.

In the end, I would say that the context decides the content. During 1980s and 1990s, the context of India as a developing nation was different that it is today. GT was just the right leader in that stage of development of India.

I salute GT, our one and only GT, a great thinker, a gracious transformer, among the greatest builders of our CSIR, who has left an indelible imprint on our minds, on CSIR and indeed on our beloved nation. He is no more, but he is everywhere for us.

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Preface

The journey of scientific discovery is often marked by remarkable individuals whose dedication and passion leave an indelible impact on their fields and beyond. This book, "Reminiscences" commemorating the 90th birth centenary of Dr. Gopalakrishnan Thyagarajan, is a tribute to one such extraordinary personality whose work has inspired and uplifted countless individuals and institutions. Through this narrative, we aim to capture not only the milestones of Dr. Thyagarajan's illustrious career but also the essence of his contributions to science and society.

The first part of the book contains encomia and tributes, which sets the tone with heartfelt accolades and reflections from those who have had the privilege of working with and knowing Dr. Thyagarajan intimately. These encomia and tributes provide a multifaceted view of his influence, painting a portrait of a man whose scientific prowess is matched by his generosity of spirit and unwavering commitment to the advancement of knowledge. The second part of the book portrays the life journey of Dr. Thyagarajan, chronicling his transformation from a budding organic chemist to a revered leader and advocate for science in small nations. The narrative explores his significant transition from an organic chemist into a Director of CSIR Laboratory, and his move across different regional research laboratories, from Jorhat to Hyderabad and then to Chennai, highlights his adaptability and the breadth of his impact across various scientific domains. Indeed, he emerged as a go-to man of CSIR due to his reputation for problem-solving skill.

The book further explores his role as a spokesman for risk mitigation and industrial safety, underscoring his dedication to creating safer industrial environments. His later years saw him transition into a science diplomat, advocating for scientific collaboration and development in small nations, embodying his vision of using science as a tool for global betterment.

Dr. Thyagarajan has the credit for looking beyond R&D and into the well-being of its staff. Characterized by his efficiency, quick decisions, correct assessment, excellent public relations, aristocratic thinking, and introduction of a “class” in every action, Dr Thyagarajan’s aura goes beyond the institutions and the industry.

This book is a homage to Dr. G. Thyagarajan’s life and legacy, intended to inspire current and future generations of scientists, leaders, and innovators. It is our hope that readers will find not only knowledge and inspiration within these pages but also a deep appreciation for the extraordinary journey of a man who dedicated his life to advancing science for the benefit of all.

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Part 1:
Encomia and Tributes

Encomia

Dr Gopalakrishnan Thyagarajan had many friends. His persona was such that many of his friends became parts of his extended family. Encomia of several of his friends carry a sense of warmth revealing a seamless integration of his professional relationship with friendship. Compilation of encomia brings out the unique persona of a man who touched the lives of people beyond the professional boundaries alone.

Prof. Harsh Gupta
Dr. R.K. Bhandari
Dr. V. Prakash
Dr. M. M. Taqui Khan[$]
Dr. T. Ramasami
Dr. S. Sivaram
Dr. M.D. Nair[$]








[$]*Extracted from edited volume brought out in 1994*

Remembering Dr. Gopalkrishna Thyagarajan (G.T.)

Harsh K. Gupta, CSIR-NGRI, Hyderabad 500007

Visiting Dr. G. Thyagarajan and Shyamala ji at their Chennai residence on 18 August 2019. They were both very healthy and happy.

My first interactions with Dr. G. Thyagarajan, the then Director of the Regional Research Laboratory, Jorhat (RRL-J) took place in the late 1970's, in the context of setting up seismometer stations in the yet un-instrumented northeastern parts of our country. As the Director of the then RRL(J), Jorhat, he readily eased himself into a role as our local nodal point and extended all possible support for our efforts. We set up the first borehole seismic station at the RRL(J) campus, drilling a 200 ft deep borehole. His positive and inclusive approach to scientific enquiry led to a collaboration between NGRI and RRL(J), which has continued till today. I carry many fond memories of those wonderful days, when we worked from early morning till late evening and played tennis on the well-lit tennis court just in front of the RRL(J) Guest House. His love and open-minded enthusiasm for scientific endeavors was a marvel and rarity.

Our interactions intensified when, in 1981 G.T. moved to RRL, Hyderabad as the Director. G.T. and his wife Shyamala ji were very friendly with our family and graced us as and when we requested them. They were dog lovers; I had seen Shyamala ji coming to receive G.T. at the airport in the company of Mark, their Laha Apso pet. As our daughters were very keen to have a pet, Shyamala ji presented my daughters a Laha Apso pup, who was christened "Dollar" and very soon became a part of our family.

Precious gift of Dollar to our daughter Benu by Shyamala ji

A year later, when I was offered to head the Center for Earth Science Studies, Trivandrum, I was in some dilemma and wished to have advice from my seniors. Some cautioned me, others hinted at skepticism. When finally, I approached G.T., he was unequivocally emphatic: "You must go! If you do not avail an opportunity, when it knocks on your door, you may regret it later". This took a huge weight off my shoulder; his words of confidence and assurance provided me just the propellant I needed to take the plunge.

During my years at the Center of Earth Science Studies, Trivandrum, Cochin University of Science and Technology, Cochin, and elsewhere, I was fortunate to enjoy GT's patronage throughout. With continued years of working in our respective scientific disciplines, there were many fundamental issues to discuss and nuances to deliberate and debate on.

Dr. G. Thyagarajan participating in a discussion meeting on future programs of Centre for Earth Science Studies,

Dr. G. Thyagarajan addressing the elite gathering of Scientists on CESS Scientific Programs (1984).

Welcoming of Dr. G. Thyagarajan to Cochin University of Science and Technology, Cochin (1989).

Dr. G. Thyagarajan on visit to Cochin University of Science and Technology along with Shri Sundarlal Bahuguna, Shri E Ahmed, Minister of Industry, Govt. of Kerala, Dr. Zahoor Qasim, Secretary to Govt. of India, Department of Ocean Development, and Dr. Hari Narain (former Director, CSIR-NGRI) during 1989.

During the period 1987 through 1991, when G. T. was the Science Advisor to Commonwealth Secretary General and Director, Commonwealth Secretariat, he invited me on several occasions to carry out scientific missions. These included a Technical Report on the disastrous Malawi earthquake of 10 March 1989, which was prepared after a 10-day long survey of Lake Malawi and its surrounding areas where the earthquake had destroyed thousands of houses. Another important assignment was the survey of the Caribbeans island nations for their vulnerability to earthquakes. Though, belonging to the discipline of Chemical Sciences, he recognized and valued and welcomed inputs from other disciplines. I so fondly remember him listening to problems related with earthquakes, water conservation, and many more.

Dr. G. Thyagarajan and Dr. Harsh K Gupta at Common Wealth Secretariat having a discussion with Sir Shridath Ramphal, Secretary General, Commonwealth of Nations, London, UK (1998).

Dr. Thyagarajan chaired the Committee on Science and Technology in Developing Countries (COSTED) during 1996-2002. During 2000-2001, when I was the Vice President of INSA and looked after its international activities, I too got involved with COSTED and had many interactions and brain storming with him on common matters. I witnessed his global concern about the problems facing the developing countries, specifically science related, and how a solution could be found.

Our later interactions were in connection with the Zaheer Science Foundation. While he was addressing the conference organized by the Zaheer Science Foundation in Goa in 2017, G. T. expressed his concern about the small nations. He observed that there are 135 independent small nations with a population of 10 million or less. Among these 135 nations, there are 45 island nations with population less than a million. These nations provide crucial scientific data for global projects. Despite their contribution, these are being marginalized scientifically and administratively. Several of these are on the verge of disappearing because of sea level rise. How can these nations be helped?

I conclude this short write-up, with a deep sense of gratitude to Dr. Gopalkrishna Thyagarajan, who had been instrumental in guiding me and many others. He brought a holistic approach to scientific endeavors, which left an imprint wherever he worked and whatever he did. His genuine approach to scientific and technical issues, his concern and friendliness for his colleagues made him one of the most admired Indian Scientists and Science Administrators of the 20th and 21st centuries.

Gopalakrishna Thyagarajan-A Visionary and Charismatic Leader

R.K. Bhandari, A Colleague at CSIR, and a fellow traveler

The news of Dr. Gopalakrishna Thyagarajan's demise came to me with a deep sense of sorrow and loss. Drifting through the long corridors of time and memory, I found myself reminiscing about the legendary figures like him whose departures have left indelible marks on the canvas of my life. The tears that welled up in my eyes were a testament to the bond we shared well over five decades, just the same way as the smile that lit my face reflected my prayers for the departed soul.

Dr. Thyagarajan, to me, was more than just a friend. He was a beacon of wisdom, support, and guidance. As a friend, he opened his heart to me, offering unstinted support and encouragement. His philosophical insights enriched my understanding of inter-personal relations and challenges, as much as his mentorship, especially in the early stages of my professional journey, reinforced my belief that human excellence knows no limits. In his company, I often had the comfort of timeless wisdom reminding me that the pursuit of knowledge is an eternal voyage.

Dr Thyagarajan, born on May 2, 1934, in Tiruvarur, Tamil Nadu, earned his M.Sc. degree in 1956. It was the year I did my high school. He completed his Ph.D. in 1962, the year I obtained my degree of Bachelor of Engineering. He pursued his post-doctoral research at the University of California, Berkeley, in 1964-65, the year I obtained master's degree in engineering from IIT Mumbai. Our fields of specialization were vastly different and yet destiny brought us together and our paths crossed again and again as members of the CSIR family, because of his friendly demeanor and our shared belief that scientific research is not of much value without its application for the greatest good of the largest number.

I heard of Dr Thyagarajan for the first time only in 1974 after my return to CSIR upon completion of my higher studies in the United Kingdom. We met for the first time in 1975 at the 4th CSIR Management Training Program held at the campus of the Central Scientific Instruments Organization (CSIO) in Chandigarh from 21-23 July. This training program was mainly built around him. His lectures were motivational. He tried hard to drive home the point that many scientists across CSIR are outstanding solo players, but CSIR needs orchestra players more. He drove home the point that whereas individual initiatives and efforts may yield good results, only teamwork could lead to the cracking of even most difficult problems. He emphasized strongly that the research and development endeavors within CSIR must closely relate to the real-world problems and must address the pressing needs of our society. According to him, the need of the hour was to pool scattered resources, harness institutional capacities, and synergize expertise present within and across the CSIR laboratories in pursuit of common objectives. The ensuing discussion brought us closer.

Our paths crossed once again when, in 1981, he took over as the Director at RRL, now Indian Institute of Chemical Technology (IICT) at Hyderabad. Later, he became Director

of the Central Leather Research Institute (CLRI), Chennai, and had tenures from 1984 to 1987; from 1990 to 1994. During the period between these two spells of service as Director, CLRI, he joined the Commonwealth Secretariat in London as Science Advisor to Commonwealth Secretary General and Secretary, CSC. His appointment at the Commonwealth Secretariat in itself was a big news at CSIR because his name was picked from a big basket of aspirants from the Commonwealth Countries. After serving the CSC for three years, he returned to his Karma Bhumi, CLRI, and transformed it into a vibrant institution.

I fondly recall our enriching engagement, especially during 1987-1990 when I was Director of Central Building Research Institute, Roorkee and during 1995- 2000, when I was Head of the International Science and Technology Directorate at CSIR headquarter in New Delhi. Two of our meetings at Commonwealth Science Council in London were highly fruitful. Our first meeting was during July 17-30, 1988, and the second meeting was during June 15-16, 1989. In the first meeting, we discussed what CSC and CSIR could do together and on a road map for advancing India's ongoing cooperation with the Building Research Establishment of the UK, particularly in the field of Fire Research. My second visit to the CSC was wholly dedicated to India's participation in an interactive meeting of the Directors of Building Research Organizations (DESBRO) from various English speaking countries including England, New Zealand, Australia, Canada, South Africa, and the USA.

My discussions with Dr. Thyagarajan and his Deputy, Dr. Raul Vicencio, this time focused on the new opportunities of cooperation in the fields of Building Materials and Disaster Management. We also agreed to exchange related literature on a regular basis. It was indeed very nice of Dr. Thyagarajan to have also introduced me to Ms. Janet R Stradran, the CSC's Executive Officer. We discussed information sharing and dissemination in the contemporary scientific landscape, with particular reference to effectively connecting CSC with CSIR laboratories, both nationally and internationally. Furthermore, during the meeting, I gained valuable insights into various software tools in the public domain.

Some of the ideas that emerged from our discussions at the CSC had to be set aside due to my deputation from CSIR to join the United Nations-Habitat in 1990. Upon my return to CSIR in 1995, with a view to giving fillip to the CSIR's International Cooperation, I crafted a proposal aiming at the establishment of International Science and Technology Directorate (ISTAD) at the CSIR Headquarter in New Delhi. I was amazed when the then Director General of CSIR, Dr. R. A. Mashelkar, not only approved the proposal on day one but infused life into it. He assured me of his all-out support and even sanctioned posts to launch ISTAD. Dr. Thyagarajan was requested to Chair the selection committee which interviewed new recruits. Dr. Rama Bansal and Dr. Purnima Rupal were selected. Dr. Bansal currently heads ISTAD, having previously served as India's Science Counsellor in Russia, while Dr. Rupal has recently retired after holding positions as India's Science Counsellor in Japan and as Director of the Indo-French Centre in New Delhi.

Even when I was posted in Colombo during 1990-1994, my meetings with Dr Thyagarajan at CLRI (and with Late Dr Appa Rao, the then Director of Structural Engineering Research Centre) always remained on my schedule, whenever I had a halt in Chennai, on flights between Colombo and Delhi. Back from Colombo in 1995, to rejoin CSIR, destiny brought me closer to him during 1996-2002, during his tenure as Science Secretary of the ICSU Committee on Science and Technology in Developing Countries (COSTED). Established in 1966 to promote science and technology as a vehicle for development in developing countries, COSTED had moved from strength to strength. Dr Y. Nayudamma became its President in 1981. Two years later, in 1983, the Government of India established its Central Secretariat in the campus of CLRI. Being very familiar with the landscape of S&T in the developing world, Dr Thyagarajan steered the affairs of COSTED with exceptional foresight and COSTED took rapid strides on the path to its progress. I vividly recall his clarity of thinking and his hard work behind the organization of many events based on the felt needs of the time. I personally participated in a brainstorming session in February 1998, at COSTED, focused on Identification of Technology needs of the Small and Medium Enterprises in the Developing World. It was a joint initiative of ICSU, COSTED, UNESCO and CSIR. This event was inaugurated by none other than Dr RA Mashelkar who made an insightful presentation to show the way forward.

The destiny brought us even closer during the period 2000-2002, when, after my superannuation from the CSIR, I was invited by the Anna University, Chennai, in 2000. My mission at the Anna University was to establish a Centre of Excellence in Disaster Mitigation and Management in the campus. I immensely benefitted from him and from Late Dr Appa Rao, Director of CSIR-SERC in Chennai.

I once again left India in 2003 to serve as Program Director of UN-Habitat in Iraq and lost contact with Dr Thyagarajan for about a couple of years. Destiny brought us together once again in 2005 when I joined the Vellore Institute of Technology at the invitation of its Chancellor.

In December 2005, I came across his speech delivered during the CSIR Foundation Day event at the National Chemical Laboratory in Pune. While expressing himself freely on the role of CSIR in the national development, he underscored the importance of developing vibrant work culture, establishing CSIR Staff College, revitalizing international collaborations, and safeguarding CSIR's autonomy. His idea of encouraging golden handshake to facilitate respectful exit of unwilling and less performing staff invoked considerable interest and we need another Thyagarajan not to let the debate prematurely end. Expressing concern over missed opportunities, he drew attention to the need for introspection on missed opportunities to widen our vision and strengthen our action plans.

As the Chairman of the Research Councils of several CSIR laboratories including CFTRI and NISCOM, he endeavored to improve institutional infrastructure, modernize laboratories, lay emphasis on team building and on finding a down to earth connection between the research outputs and fulfilment of the felt needs of the end users. Interalia, he also played a significant role in giving fillip to sports promotion activities in the CSIR and in the process, I was also motivated to host CSIR's Shanti Swarup Bhatnagar tournament in the campus of Central Building Research Institute in Roorkee.

I recall his thrust on leveraging the power of Information Communication Technology during my discussions with him while he was at the CSC. After years, in 2000, I submitted a project proposal to the High-Powered Committee on Disasters established by the Government of India aiming at establishment of a Disaster Knowledge Network. Chairman of the HPC urgently convened a National Workshop on July 14 - 15, 2000 at Bhopal to discuss the proposal. In parallel, my proposal received strong support from Dr. Mashelkar, CSIR Director General, so much so that on September 1, 2000, Dr Mashelkar formally wrote to Shri J.C. Pant, the Chairman of the High-Powered Committee to assure his full support. About the same time, the unwavering endorsement of the proposal by Dr. Anil Kakodkar, the then President of the Indian National Academy of Engineering, gave further momentum to the initiative. On November 16, 2000, in his address to Media on National Press Day, Shri J.C. Pant acknowledged the support received from Dr Mashelkar and Dr. Kakodkar for establishing Disaster Knowledge Network. Finally, in October 2001, the High-Powered Committee included the recommendation in its report submitted to the Government of India. Recalling my meeting with Dr. Thyagarajan during his tenure at the CSC, I also submitted a similar proposal on establishment of a Commonwealth Disaster Knowledge Network to his successor. On September 28, 2000, CSC approved the proposal and sanctioned seed funding of £5,000 to initiate the DKN initiative in collaboration with UNESCO.

Despite the geographical distances that separated us, our occasional meetings served as poignant reminders of the enduring bond we shared. My last meeting with Dr Thyagarajan was at the International Conference on Science and the Small Nations, held in New Delhi on November 14-16, 2017. It epitomized his unwavering commitment to uplifting the marginalized voices in the global scientific discourse. It was organized by Zaheer Science Foundation, (ZSF) of which he was the Chairman. While inviting me to be a speaker at the conference, he expressed his deep concern about the plight of the small nations. Of the 197 independent nations at that time, 135 had population of 10 million or less. Of these 135, 45 were small island nations with population of one million or less. Despite these island nations being principal contributors of data and information to feed countless global projects on climate change, extreme weather events, sea level rise, natural disasters, and trans-boundary pollution, they faced the threat of science and technology marginalization. In my presentation, he specifically asked me to suggest what should be done to rectify the imbalances and what policies and strategies can help integrate the small and disadvantaged nations with the ongoing and perceived global scientific initiatives.

As I bid farewell to Dr. Thyagarajan, I salute a visionary, a mentor, and above all, a dear friend, whose memory will forever live in the hearts of those fortunate enough to have known him. May his soul find eternal peace.

Festschrift to Dr G Thyagarajan

V Prakash, Former Director of CFTRI, Mysore

It's a great loss to the fraternity of Chemists and Chemical Engineers and CSIR in particular and the family of Dr Thyagarajan in his passing away at Chennai on March 24 2024. The message was shocking to some of us who live away from Chennai and could not go to Chennai immediately. But when I talked to Ravi his son at Chennai, myself and Dr P G Rao former Director of NEIST, Jorhat could go together to Whispering Heights where Dr Thyagarajan lived to give our Condolences on April 2, 2024.

Subsequently Dr Sreeram, Director of CLRI requested me to share a few lines in memory of my salient interactions with Dr Thyagarajan for over more than 35 long years.

I decided to keep it short as many would have covered in this Festschrift to the multi-dimensional role that Dr Thyagarajan has played in several fields in his long career of several decades. His Birthday of 90 being celebrated at CLRI is indeed the right way to offer our respects to GT.

My introduction to GT (I use this abbreviation as many of us know him more as GT!) was through late Dr M S Narasinga Rao formerly of RRL Hyderabad and later moved to CFTRI in 1970s). As a research fellow I was very keen to meet GT but there was no opportunity to meet him. Years passed by and in mid 1980s Dr B L Amla former Director of CFTRI and GT being very close as Co-Directors (The only Scientist in the CSIR history who was Director of three CSIR Laboratories at different times and lead them from the front and trained people to become leaders in these laboratories was GT) invited GT to Mysore as a Chief Guest for one of the symposia (Before GT left to Common Wealth assignment at London). I almost self-invited to meet him in the CFTRI Guest House and indicated my keenness to talk to him as I was also a Chemistry Graduate keenly interested in the subject. GT over a cup of tea mentioned to me that Chemistry is the basis of Science in one way or the other and said "your strength in Chemistry is astonishing (as I had carried some of my papers with me to show him) and pursue with passion". That encouraged me to move forward with boldness and confidence. In 1994 when I took over as Director of CFTRI, GT was nominated as Chair of Research Council. That was a great opportunity to work with him. Our closeness built over period of time and shared many Visions and Missions that CFTRI took at that time with his guidance. That's the time he became busy with COSTED at Chennai and I was in many symposia, workshops and training Scientists from Low-income countries to build science as a ladder of success for their country and its policies at COSTED. The strong relationship professionally built as series of innovations and his suggestion of CAC (CFTRI Annual Conference with Industries and recognizing them) was a great success annually. The global giants and startups (the word was not much used at that time in India) shared the same platform bringing in synergy. It was GT's way of networking and bridging R and D Institutions & Industry - Industry Interactions. It indeed had an astounding success as a model for many academic Institutions.

Around that time in 2004 December 26th early morning the mammoth Tsunami hit hard the East coast of India very badly. Thousands were homeless and lost their near and dear. CFTRI within 24 hours swung into action to supply safe Packaged and sterilized Traditional Foods of Tamil Nadu along with packaged drinking water for each devasted Families lodged in schools, choultries and community halls a total pack that can last for 5 - 8 days so that Food portion (packed separately as lunch and Dinner) with multi spread of menu for 5 to 8 days reached the east Coast from thanks to Dr RA Mashelkar the then DG CSIR whose encouragement stood with us as a strong support. It is at that moment GT called me and congratulated CFTRI for the unique effort for almost 12 days 24x7 to cater to the east coast victims and families. His suggestion was use COSTED space for storage (adjoining CLRI Campus) and said also "add pickles packet to the Food packets you are giving". As most of you would know Tamil Nadu no Sapad without Pickles!! We added it as extra packets in each mega pack and a thundering success and people loved the Food which had the traditional taste of what they are used to especially in that distress. All prepared hygienically, sterile packed with more than 6 months' shelf life and Such was his way of keen observation and just in time suggestion. What one can see is that suggestion which was so important for the Food to make it tasty and acceptable to the Local suffering population both Rich and poor all simultaneously washed away.

The nation at that time had another major issue that of Pesticide residue in Beverages. JPC was formed to investigate and was headlines all over. Govt. resorted to CSIR to give solutions and Dr RA Mashelkar the then DG of CSIR requested me to Delhi to discuss as it was Food and Pesticides issue and there was a dire need to have a technical committee to sit through more than 40 meetings with many parliamentarians, Industries, R and D labs, NGO organizations and analytical laboratories and make a report to the Govt. The obvious choice at that time was none other than Dr Thyagarajan who had so much experience in Pesticides and Analytical Chemistry and its effects and also to look at the problem as an outsider and fair to all. GT committed himself to the Job for three continuous months at Delhi and a report was made and discussed with Dr Mashelkar. The end result was the formation of FSSAI and Regulations for water with Zero pesticides (surrogate to Zero) for any food use in industry. The protocol was laid down and the country saw a new Beginning of India as Atma Nirbhar Bharath making its own Scientific regulations better and more rigorous than many countries and Walk the Talk. This is when I learnt the real Science part of GT and looking things dispassionately and making sure the decisions are fair from a scientific stand point of view. A new Era was born in India's Food safety concerns. Thanks to Dr Thyagarajan for Chairing the Technical Committee and making the timely report. Of course, CSIR and CFTRI have always been there to all necessary extend whatever support. This was a game Changer that GT brought to the Country.

Subsequently during 2011 till 2024 there was always no trip for me to Chennai without meeting GT and family.! They became so close to me and my family. Such was the way he built the relationships with people and nurtured them as leaders and encouraged them by giving his experience in practice and as narratives.

These are some two to three examples that I recollect which paved the way for new vistas in Chemistry and Chemical Engineering, Analytical Chemistry led by Dr G Thyagarajan for the future generations to emulate.

His advice, the clarity of thinking and even the way he would definitely say Yes or No was so familiar to some of us we already have started missing it. A great innings that GT played for CSIR, for Common Wealth Countries, for COSTED and for the Nation in terms of crises that we are ever grateful to him for that Scientist in him and a Leader in him too.

Many GTs associates and students meet often and share some experiences and recall memorable times spent with him from time to time. Grateful to you Dr Thyagarajan for your service to Humanity.

With my Salutations to GT Saheb!

Dr Thyagarajan, Scientist, Friend, and a Humanitarian

(Extracted from Tribute published in 1994)

Professor M M Taqui Khan, Emeritus Scientist, Department of Chemistry,
Osmania University, Hyderabad - 500 007

When I had started writing about my dearest friend Dr Thyagarajan, I could hardly realize how quickly the time flies. The sand clock of time empties several times, unfelt, unnoticed, and unperturbed adding only rich experiments and remembrances. When I look back forty years, I see Dr Thyagarajan as a student of B.Sc. (final), Nizam College when I had joined the College as a Lecturer in Chemistry in 1952. Thus, a gap of about three years separated our careers and age. He was quite a dynamic enthusiastic young man with scholastic and leadership qualities. I saw the charming side of his personality on several occasions in the college which grew into a lasting friendship. He joined RRL (now IICT), Hyderabad after completing his M.Sc. from Osmania University with distinction. Some of his classmates were my wife's close friends, so we became family friends. After my return from USA in 1962, my contacts with RRL grew stronger due to my personnel friendship with Dr G S Sidhu, the then Director, RRL and Dr Thyagarajan. It was a matter of pride for all of us when he was selected by Dr Nayudamma to head RRL, Jorhat at a comparatively young age. He is a unique example of a Scientist who has headed three CSIR Laboratories in a total span of about twenty years.

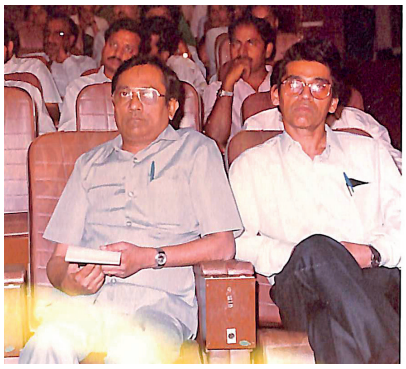
When I became the Director of CSMCRI Bhavnagar in March 1982 it gave me an opportunity to watch capabilities and leadership qualities of Dr Thyagarajan on several occasions, at the time of Directors Conference and as a Chairman of Inter-Laboratory Research Meetings of the Chemical Group of CSIR laboratories. In my opinion, one of his most successful programs was pesticides which had placed RRL, Jorhat and RRL, Hyderabad on the forefront of technical research. After taking over as the Director of CLRI, he has made the laboratory a pioneer in leather research and technology and torchlight for the training of younger scientists in leather technology and an asset for the guidance of entrepreneurs for leather trade and export. As a person associated with CLRI from the days of Dr Nayudamma, I can state the fact that CLRI is the best and ideal example of the liaison between research, trade and industry and Dr Thyagarajan had taken this to the pinnacle of success. As an adviser to the Secretary General of the Commonwealth Science Council he had helped in bringing together the Scientists of UK and other Commonwealth Nations and Indian programs of mutual interest.

The quality of a true leader is that he should be respected not for his power or position but for his leadership qualities and humanitarian approach and Dr Thyagarajan is a perfect combination of these qualities. Hyderabad had given several Directors to CSIR and who had carried the torch with the true Hyderabadi culture of decency, love, broad-mindedness and open heartedness, the traits that cut across all the barriers of race, provincial, linguistic, and religious differences. My friend Thyag is the best example of this culture. Despite his heavy schedule, he came to Bhavnagar at the time of my laying down the office of the Director on 30 Nov 1991 and headed the function. This is my humble tribute to my dearest

friend at the time of his superannuation after a distinguished service of about forty years in CSIR. Thyag is still young and dynamic. It is up to the country to take advantage of his rich experience, especially in the post GATT era.

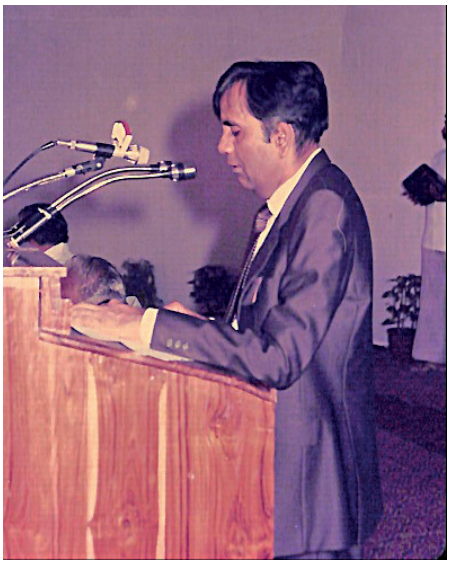
Dr Thyagarajan, a leader par excellence in the Council of Scientific and Industrial Research family

T. Ramasami, Former Secretary to the Government of India, Ministry of Science and Technology and Former Director of CSIR-CLRI



Dr G Thyagarajan is a name that reverberates across the entire family of Council of Scientific and Industrial Research in one voice "He is our man." Rarely any one human being could dream of such a status across and agency of thousands of people in its long years of national service. Such is the impact of Dr G Thyagarajan in the CSIR family. It is only befitting that we recall the path of this impactful man and pay our homage. This homage is made on behalf of both Dr K V Raghavan (who is not among us any more) and the author.

I came across Dr G Thyagarajan for the first time in October 1984. He was a member of the committee that selected me for the appointment at CLRI. He was penetrative and probing. His questions were based on deep understanding of the several aspects of managerial issues of an intra mural research agency with more than 25000 staff members. In the evolutionary history of CLRI, 1983 was a year of internal crisis. Organizational morale was low on account of factors beyond the control of any research organization. There were rumors floating in the air that Dr Thyagarajan would soon become the Director of CLRI. Dr Thyagarajan had, by then, carried the reputation of a dynamic director of the entire CSIR system through his work at Regional Research Laboratories at Jorhat and Hyderabad. In a few weeks, he did assume charge as the Director of Central Leather Research Institute.



I recall vividly his first address delivered to staff and students of CLRI on the 29th of November 1984. It was not just captivating. It had a stellar impact on the house. Morale building was written all over the speech. In his first address, he made announcements that six major infrastructural investments would be made at CLRI. He touched the hearts of people with his first address. He was an instant success. It is to his credit that all the major announcements on investments were realized in a planned manner. At the end of his talk on the 29th of November 1984, he called me aside and said "Both you and I have jobs to do for CLRI. I must find the resources. You should win the Shanthi Swarup Bhatnagar Prize for CLRI in return for those investments." Lo be hold! In hindsight we both met the expectations. This one anecdote is an adequately revealing footprint of a visionary leader who connected organizational causes with resources.

The morale of CLRI was rebuilt. The master who held keys for all doors in CSIR opened the chest of good will among decision makers in CSIR, Head Quarters within weeks. Resources started to flow in the direction of CLRI. He chose to seek the relocation of Dr K V Raghavan from RRL Jorhat to CLRI. We earned an elder brother in Dr KV Raghavan. Watching Dr GT from close quarters, both Dr KV Raghavan and I learnt that the leadership was nothing but "The Art of persuasion." In the history of CSIR, there were only a few who were at the helm of affairs in three different constituent laboratories. He made all of them peak their performance during his own tenure. He brought enormous social skills and ability to win over the hearts of both stake- and shareholders. In the parlance of Indian leather sector, the acronym GT became an abbreviation for Golden Touch. Truly he had the Midas Touch on the Indian leather sector.

The year 1984 became landmark year for the Indian leather sector. Council for Leather Exports was formed. India International Leather Fair assumed new proportions. Tanner's Get Together became Leather Research Industry Get together in 1991. CLRI became the cynosure of the sector under GT. While serving as the Director of CLRI, he had the entire CSIR in his horizon. Both Dr KV Raghavan and I were trusted and empowered to play the complementing roles of development engineer and institutional designer, respectively. He was investing into the leadership pipeline of the institution. That we both succeeded him as Directors of CLRI in seamless fashions after his tenure is the hallmark of GT's leadership development profile. All the major programs and initiatives in CLRI during his tenure prospered. In the evolutionary history of CLRI, the care of an Amma (Dr Nayudamma) at the early times, an Appa (Dr M Santappa) at the mid stages and a Rajan (Dr G Thyagarajan) with Golden Touch (at the times of challenge) are well documented. I have personally worked with him on several Pan CSIR and national matters while he served as the Director of CLRI. His understanding of human behavior and social groups was amazing and revealing. He was a truly a coordinator and a leader who invested into people, nourished them and got the best out of the teams he led. There is no wonder

that Golden Touch acronym came to be celebrated in references made of during his own lifetime. He connected to people and earned their trust. He was a leader of transformational changes in CSIR laboratories.

Today CLRI is acclaimed as the Global leader in leather research. He laid the foundation for global eminence and a safety net for people to perform. People who followed him including Dr K V Raghavan and I built the super structure. Today CLRI is rich with its leadership pipeline. He had chaired several national and CSIR committees and made defining contributions to the overall wellbeing of CSIR. During his service, his was a name that elicited family like sensation across several thousands of employees. Madam Shyamala Thyagarajan brought motherly affection to all working in the organizations headed by Dr GT. This does not happen unless one invests oneself totally into the cause of the institution and behave like the head of a family. To him CSIR was his family. Well-being of the family was his only focus. His immediate family dissolved itself into the larger extended family of GT's workplace.

CLRI is unique. There are two names from CLRI which remain carved in the hearts of people across the agency of CSIR even amidst intergenerational divides and gaps. One is Dr Nayudamma and other is Dr G Thyagarajan. I feel blessed that I worked with both. I have heard Dr GT referring Dr Nayudamma as his own mentor. I pay this tribute to GT@90 on behalf of both Dr KVR and me. I salute the two men who made CSIR their life missions. May this breed grow in the service of CSIR and prosper.

The commemoration of his 90th birth anniversary is an occasion to celebrate the life and services of Dr G Thyagarajan to CSIR.

GT I knew: Some fond memories

Dr Swaminathan Sivaram, Professor Emeritus, Indian Institute of Science Education and Research, Pune, Former Director, CSIR-NCL (2002-10)

Dr G. Thyagarajan (GT to many) was an iconic leader of Indian science and technology whom we looked upon as a role model growing up in the mid-seventies. I have had the distinct and unique pleasure of meeting and interacting with GT at different junctures of mine and his life; and every time, it has been a refreshing encounter with significant learning opportunities. It is difficult to compress my feelings and express them in few words in a short narration. Nevertheless, let me try.

GT was a phenomenon. I will not speak about his record Directorship of three CSIR laboratories, one of the youngest people in CSIR to be appointed a director (at the age of 40), someone who had the rare distinction of being a DG CSIR for seven days and a superb science administrator and diplomat who brought CSIR national and global visibility. Neither will I talk about his stellar contributions to the birth of India's generic agrochemical industry, thus, playing a pivotal role in India's Green Revolution, and contributing to India's transformation from a "begging-bowl" to a nation that produces food in abundance to feed its 1.4 billion people. He moved to CLRI at a critical time and reinvented its purpose with focus on sustainability, stewardship of the environment and set the stage for Indian leather industry to be a global trendsetter in fashion and products. These are accomplishments that should be written in bold-letters for future generations to understand how publicly funded research institutions can contribute to the transformation and growth of a nation.

There are others who can tell these stories better than me and exemplify his leadership role displayed under challenging circumstances to energize CSIR scientists to rise and perform extraordinary feats.

My first meeting with GT was in 1976, when I was just 30 years old with less than two years as a working professional in India. I was on a visit to Assam with my wife on a belated "honeymoon". I invited myself to RRL-Jorhat and received a warm letter from the Director, GT extending an invitation. I spent a day at RRL-J, my first in any CSIR Laboratory. I was touched by the warmth of his hospitality and generosity with time to entertain a nobody like me. He, accompanied by his trusted colleague Dr Raghavan, escorted me through the laboratories to show me the breadth and depth of work that was being carried out. I saw the pilot plants for agrochemicals churning out products that were to change the fortunes of India. I was deeply impressed with the zeal and purpose of the Laboratory to contribute to the growth of India. I saw S&T being harnessed with a purpose to meet the needs of our country. This left an indelible impression on me and shaped my own persona over the years. The lesson I learnt from GT at that time was how to be generous with younger people which can leave an enduring imprint on a young mind and how S&T could be a powerful instrument of national transformation.

It was a decade later, I met him again, this time as a member of the RC of CLRI-Madras. He was the Director and the year was 1984 I wonder whether he had a role in picking me from IPCL, Baroda because of my meeting with him almost a decade earlier! In several RC Meetings I saw his leadership of the laboratory, firm but compassionate, formal yet collegial. This was lesson 101 in managing a large scientific laboratory and taking people along in decision making. The meetings were conducted with rare professionalism and with ample scope for each one of us to express our views freely. These lessons will come of use to me eighteen years later when I assumed the leadership of CSIR-NCL.

Soon, we met again at Bhopal, as fellow-members of the Committee set up by the then DG-CSIR, Dr S Varadarajan to diffuse the rather precarious situation that existed immediately after the leakage of MIC at the UCC plant on December 3, 1984. The team members were drawn from industry and CSIR laboratories. I can still vividly remember the thoughtful and wise counsel of GT to our deliberations every morning at the Camp Office located at BHEL Guest House in Bhopal. Interacting with him at that time was another learning experience for me. I learnt from GT the importance of having a breadth of vision, knowledge beyond one's own specialized area and the benefit of being able to connect the seemingly unconnected dots.

I could repay my debts to GT by inviting him to CSIR-NCL and requesting him to deliver the CSIR Foundation Day Lecture in September 2005. I had initiated a lecture series, titled" Builders of CSIR" to enlighten the next generation of CSIR scientists about the contributions of its past leaders. He gave a scintillating talk, titled, "The CSIR in India's life and part of it: Glimpses of events, people and places". In this lecture GT reminisced on the origin and growth of CSIR. Laced with humor, he talked about distinct styles of all the past and present DG-CSIR. With characteristic candor he pointed out CSIR weaknesses and several prescriptions for improvement. He touched upon the need for better work culture, improved focus on human resources and the desirability CSIR to develop a global outlook. These words, borne out of his deep understanding of CSIR, ring true even today!

The last time I met him was in Chennai in August 2023. Dr. Ramasami and I called on him at his residence. He was a frail man ravaged by the passage of time and age. When he saw us, there was sparkle in his eyes. Though hard of hearing and unable to speak with clarity, he remembered many events of yesteryears with deep fondness and pride. He held my hands and wanted to share many thoughts that were rushing into his mind but was finding difficult to find expression in words. It was sad to see a debonair GT in this state of existence. In that moment, I learnt another life's lesson. However, strong, and powerful you were in your halcyon days, the relentless and unforgiving march of time and age levels us all by the time we reach the end of life.

But the memory of GT that I will always carry is that of an inspirational science leader, deeply committed to harness S&T for the good of the people of India, a builder of institutions with enduring values, someone who excelled in his sartorial style, always dressed impeccably either with a tie or a bow, a gentle and generous soul who lived his life on this earth on his own terms with head held high and dignity and in departing, left behind, deep imprints in the "sands of time".

Dr G Thyagarajan delivering the CSIR Foundation Day Lecture at National Chemical laboratory, Pune, September 2005

The GT I Know

(Extracted from Tribute published in 1994)

Dr M D Nair, SPIC Science Foundation, Madras 600 032

The rise of Dr Thyagarajan to his present status as an outstanding manager and leader of scientific research reflects the growth of CSIR in this country, set up with a sense of unparalleled vision and rare fortitude in the forties. To those of us who have been outside the inner circle of CSIR and have seen its growth from the periphery, the Council remained an enigma, an organizational structure which believed in changing its course, trying to adjust itself to the vicissitudes of a demanding political and social milieu and in the process losing sight, often of the primary objectives embodied during the setting up of India's first Board of Scientific and Industrial Research in April 1940. Yet, even during those days of uncertainty leading to a labyrinth of ideas, policies, and practices, a few of the over 40 CSIR institutions represented stability, deep sense of purpose and clear-cut objectives in their basic structure and make-up. One such laboratory under the CSIR network has been the Central Leather Research Institute. Blessed as it has been by having as its directors, outstanding leaders of scientific research and industrial acumen, CLRI has not only been consistent, but also purposeful in its efforts in promoting the cause of leather research from all its multi-faceted angles.

My first acquaintance with GT was, as it always happens, at a formal level, meeting him at Scientific Conferences when one has very little time to know the man, let alone assess his overall abilities, I knew him as a very competent organic chemist, trained in the highest traditions of classical organic chemistry under the well-known Professor Rapoport at Berkeley. Like many of us, he too must have returned to India starry-eyed with visions of continuing in the same mould of state-of-the-art organic chemistry, primarily of the academic variety. Even though, organic chemistry in India could boast in those days of some outstanding groups, in Delhi, Calcutta, Madras and Bangalore, new-comers did not find it very easy to penetrate these 'groups of well- entrenched teams since many of them represented the classical 'guru-shishya parampara'. Notwithstanding the fact that, I never had an opportunity to discuss with GT his own evolution into the organic chemistry firmament in India and the background of his entering the holy precincts of CSIR. I imagine his entry was catalyzed by the desire of Dr Zaheer to attract talented youngsters in the hope of developing an institution which, for the first time in India, considered industrial research as equally respectable and challenging as any other scientific vocation.

The entry of GT into the then RRL, Hyderabad, perhaps paved the way for much of his success, much of his acumen, much of his interest in men and material and much of his management skills in future years. His leadership qualities were further sharpened by the opportunities provided at RRL, Jorhat and then at RRL, Hyderabad, he having very successfully and creditably adorned the Director's Chair, in both places. During his Directorship at RRL, Hyderabad, my own acquaintance with GT grew into a friendship which I have always cherished ever since moving as Director of CLRI at Madras, was considered by many as a masterstroke by the CSIR management of those days since CLRI

needed a man who had through his inborn capabilities and cultivated skills, made himself a leader of scientists and research managers.

The CLRI is a unique institute even within the CSIR family, which is very visible and highly accountable to the industry as it is intended to assist, nurture, and promote leather research. The leather industry, with Tamil Nadu as a focal point, always needed modern tools, methodologies, technologies, and marketing skills to survive in an ever- changing and highly competitive international environment. Since many leather exporting companies have very little access to these from their own internal resources, there is every need for the institute endowed as it is with 'state-of-the-are scientific knowledge, instruments, and scientists to help and assist them in all their endeavors.

GT did fit into these schemes of things beautifully. His 'escape from the rigors and pressures of running an institution with an annual revenue budget of over six crores to take up a very senior appointment as the Scientific Adviser to the Secretary General of the Commonwealth Secretariat at London, was perhaps a welcome interim relief for him. I did meet him and his family at London couple of times during that phase and those visits were always immensely pleasurable considering the intensity of the hospitality that GT and Shyamala showered on their friends at any time of the day or night. From all accounts, that I have heard, he did a marvelous job at this onerous assignment of global dimensions, meeting with and negotiating with countries and scientific statesmen of diverse cultures, attitudes, and approaches.

The sense of great courage and equanimity that the family displayed during, perhaps the most traumatic period of their life spoke volumes of the caliber and strength of character that GT and Shyamala had built up over the years. Lesser people would not have found it easy to come out unscathed from events of the magnitude that they faced.

GT is retiring from his Directorship of CLRI. To my mind, it is just a change of phase, yet another milestone in his eventful career. He is already planning the practice of his art on a much wider canvas, something which will be, perhaps even more demanding of his multifarious skills and infinitely more challenging. To me at least, sitting outside the system he has for so long nurtured with fondness, care and dignity, his knowledge and skills will not be lost to CSIR and the leather industry, his latest and perhaps, now a permanent love. On the other hand, CSIR and the industry would do well to continue to tap his abundantly available knowledge and skills and the enviable energy that he possesses.

Tributes

Dr A.V. Rama Rao[$]
Dr N. Chandrakumar[$]
Dr Ganga Radhakrishnan

[$]*Extracted from edited volume brought out in 1994*



Dr. Thyagarajan

(Extracted from Tribute published in 1994)

Dr A V Rama Rao, Director, Indian Institute of Chemical Technology, Hyderabad 500 007

I am happy to contribute to this Special Volume that is being brought out on the occasion of Dr G Thyagarajan laying down the office of the Director, CLRI, Madras. I have known Dr Thyagarajan for many years as a fellow scientist of CSIR and subsequent to taking over the Directorship, from him, of the Regional Research Laboratory (presently the Indian Institute of Chemical Technology), Hyderabad. I have had the opportunity to interact with him as a colleague of equal status and responsibilities. My experience in this respect has been that Dr Thyagarajan is a very dynamic officer with high enterprise to deal with problems.

I have taken a keen interest in the work done by Dr Thyagarajan in the field of Organic Synthesis, particularly to the Heterocyclic compounds. Dr Thyagarajan, it may be said, was the main force behind the formulation of a policy for the development of agrochemicals, particularly pesticides, in the CSIR laboratories. He had the vision to foresee the importance of the development of indigenous technologies for pesticides and other agrochemicals that are badly needed by the agriculture sector in the country and over the years was, directly or indirectly, responsible for many programs and process development work for the pesticides, first at RRL, Jorhat and subsequently at Hyderabad. This impetus given around the early 70s, has resulted in the CSIR laboratories, particularly the IICT, Hyderabad, developing the technologies and transferring them to the Indian Agrochemical Industry. I recall one happy occasion, when I happened to be at RRL, Hyderabad when the demonstration work for Diazepam was being carried out at the pilot plant in RRL, and this perhaps was a precursor for many such technologies developed at IICT.

Dr Thyagarajan, as a science administrator, distinguished himself in the planning of programs of R&D work in many laboratories of CSIR and in general has given a sense of thrust and direction for many major R&D programs in CSIR. He also had the distinction of having studied the science and technology problems confronting the developing countries of the Commonwealth while he was the Secretary and Scientific Adviser at CSC during the period 1987-90.

As a scientist, Dr Thyagarajan is farsighted and ambitious and also pragmatic at science policy decisions and this trait has been amply reflected in his present program formulated for the Indian Leather Sector to reach great heights by the year 2000 A.D. and beyond, both in export of leather goods and development of modern technologies.

I wish Dr Thyagarajan all the best and great strength for carrying out his future plans, after his retirement from CSIR. I hope that in his scheme of plans for future, the Indian Chemical Industry too would find a place and thus get directed and enriched by his vast experience. I take this opportunity to wish Dr Thyagarajan and Mrs Thyagarajan, a gentle and admirable lady, many many years of fruitful activity, peace and prosperity.

Tribute to Dr G Thyagarajan

(Extracted from Tribute published in 1994)

Dr N Chandrakumar, Chemical Physics Division, CLRI

Dr Thyagarajan's contributions to the all-round development of CLRI and the pre-eminent role he has played in guiding the destiny of the institute, bringing it to its present stature, are too Well known to bear repetition by me. Instead, I shall take this opportunity to salute him by dwelling on the approach he has taken to fostering an area of Spectroscopy that many Institute Managements often mistake for merely analytical services, giving impetus to basic research contributions in this area, recognizing at the same time the untapped potential in applications of the technique.

It is in no small measure owing to his broad vision of S&T that Nuclear Magnetic Resonance research is today a major area of investigation at CLRI. Not content with the basic research that has been performed in this area at CLRI, he has always urged development of this tool in applications to leather and to materials research. As a result, NMR micro imaging and diffusion studies are being taken up as an effort in this direction. I may point out that CLRI is the first CSIR lab to be involved in the area of NMR Micro imaging, and indeed one of the first two institutes in India to enter this field. In achieving this, Dr. Thyagarajan has been instrumental in mobilizing both CSIR and DRDO support.

In December 1991, CLRI organized and hosted a National Workshop on Localized (Spatially Resolved) NMR, with participation of a number of International Experts, as an effort at sensitization in this frontier area. I recall with delight that Dr Thyagarajan spared no effort in involving as broad a spectrum of the Indian S&T community as possible in this exercise, including experts in Medical Sciences, Engineering Sciences, and the natural sciences. Not surprisingly, a distinguished Session Chairman at the workshop characterized it as another first -a feather in the cap of Dr. Thyagarajan.

In March 1993, CLRI played host to Professor Richard R Ernst, Nobel Laureate (Chemistry, 1991), ETH, Switzer/and, who won the Prize for his contributions to the development of the methodology of High Resolution NMR Spectroscopy. A three-lecture series was delivered by the distinguished guest. Once again, Dr Thyagarajan took keen interest in bringing off this program. Typical of his holistic approach, he was particularly keen that the University and College community should be involved in interaction with the Laureate and that the younger generation of students, in particular, should have the benefit of such a rare exposure to a distinguished Scientist. He handled with his customary tact and aplomb some tricky moments that cropped up, in meeting this concern.

The range of his reach and the pace of his work have always been inspiring. That combined the concerns of the Leather industry, for example in setting up CAD facilities at CLRI, with societal concerns, in involvement with some of Thavathiru Kundrakudi Adigalaar's projects, and in organizing numerous Training Programs and Workshops/Symposia under

the aegis of the Commonwealth Science Council which he piloted for three years, speaks volumes of Dr Thyagarajan, requiring no elaboration.

Public funding of Science in India would appear now to be at the crossroads. Here again, I note with deep satisfaction Dr. Thyagarajan's concern in initiating and founding a mechanism which could fund the future acquisition of major equipment at CLRI, ploughing back revenues earned by industrial project activities.

It is not often that one has the privilege of working with outstanding men. I must count myself
fortunate in having had such an opportunity. In Dr Thyagarajan, one could indeed sense a unique combination of strength and optimism, polish and dignity, drive and extraordinary management skills, a quest for excellence coupled with generous fair-mindedness.
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Tribute to Dr. GT

Dr. Ganga Radhakrishnan, Former
Chief Scientist, CSIR-Central Leather Research Institute, Adyar, Chennai 600020

With a great sense of pride and happiness, I share my association with Dr. Thyagarajan (fondly called GT by all) for more than forty years. I vividly remember the time in 1984, when he delivered his inaugural address upon becoming the Director of CLRI. He mesmerized the entire technical and research staff, students, and administrators alike with his compelling vision and ambitious plans to shape the future of our revered institution. More importantly, Dr. GT touched the personal lives of the CLRI staff by transforming the infrastructure through numerous improvements such as establishing a new medical dispensary, building a new hostel, the famous landmark triple-helix auditorium for seminars and conferences, CAD-CAM facilities for leather goods and footwear departments, sophisticated analytical instruments for research, and modernizing the library. On a daily basis, Dr. GT would interact personally with research scholars from all departments, encouraging their participation in national and international seminars and conferences. His connections and associations in science and technology, both nationally and internationally, helped many CLRI researchers expand their horizons in their respective research fields. Dr. GT was instrumental in modernizing leather research and commanded deep respect from peer researchers and leaders in the leather industry. During this era of forward-thinking research programming, I was fortunate to belong to the Polymer Science and Technology division. I supervised more than 25 PhD scholars in my group, many of whom continue to contribute significantly to academia and the industrial sectors. Thanks to his support, I was also able to establish a sophisticated analytical laboratory at the forefront of polymer sciences and quantitative techniques.

With a generous grant from the Ministry of Commerce in 1990, a comprehensive center for Eco Testing, EXCEL, was established at CLRI. This center received dedicated support from Dr. GT himself and other leaders like Dr. T. Ramasami and Dr. K.V. Raghavan, and transformed into an excellent testing facility for international leather exports. I am thrilled to note that this path has continued to this day, and this same center has evolved into a more vigorous and dynamic establishment thanks to the direct support and leadership of the current Director, Dr. K. J. Sreeram.

After my superannuation from CLRI in the year 2006, I was asked by Dr. T. Ramasami, the then Secretary to DST, to take on the honorary charge of CCSTDS, formerly known as COSTED. Dr. GT was a key member of a science and technology committee focusing on developing nations. He contributed significantly to science education and communication, emphasizing the application of technologies to human needs and their direct societal impact.

Our paths crossed yet again. Under Dr. GT's vision and leadership, and in line with programs of COSTED, at CCSTDS we established and funded several programs involving the preparation of teaching aids, computer training, and electronic software development, awarding travel fellowships, organizing conferences, seminars, workshops, and training

courses, and publishing books and proceedings of conferences on frontier areas of science and technology relevant to developing countries.

Since April 2010, the Centre for International Cooperation in Science (CICS) has promoted activities laid down by INSA/DST, such as the INSA-JRD Tata Fellowship, TWAS-DST Fellowship for Researchers from developing countries, DBT-TWAS Biotechnology Fellowships, INSA-CSIR-DAE/BRNS-ISRO-CCSTDS Travel Fellowships, and training programs for Women Scientists on developing patents, and science motivational programming for school children. Based on these efforts and initiatives spearheaded by Dr. GT, the CICS even produced a compendium of research training documents for researchers from developing countries mentored under the supervision of DST Secretary Dr. T. Ramasami in 2011.

During the same year, Dr. GT, the then president of the Madras Science Foundation, along with myself as the Honorary Director of CICS, Dr. A.B. Mandal, then the Director of CLRI, organized an international seminar on Chemistry for societal and environmental needs, during which leading national and international experts delivered numerous lectures to a large and diverse audience in our own Triple Helix Auditorium.

Reminiscing these wonderful, fruitful, and productive years of my professional life at CLRI, I would like to take a moment to recall and acknowledge with fondness my association and friendship with Mrs. Shyamala Thyagarajan, the wife of Dr. GT. With sincerity and honor, I pay my homage to Dr. GT and note his transformative impact on me as a scientist and on every colleague, he has interacted at CLRI and beyond.

Part 2

Metamorphosis of an Organic chemist into A Champion of Science for Small Nations: Life Journey of Dr Gopalakrishnan Thyagarajan

Making of an Organic Chemist: Dr Gopalakrishnan Thyagarajan came from a small village setting in Tanjore district in Tamil Nadu and emerged into a reputed organic chemist backed by education and research at Hyderabad. He was, in some sense, a homegrown seed of a CSIR laboratory. He started as a graduate apprentice at the then Regional Research Laboratory in Hyderabad. He was tutored and nurtured under the tutelage of two men who rose to become Director Generals of Council of Scientific and Industrial Research. His talents and reach grew beyond the boundaries of organic chemistry. There are valuable lessons from the evolution of an organic chemist into a champion of "Science for small nations".

Transition of an Organic Chemist into a Director of CSIR Laboratory: Dr G Thyagarajan was much more than a scientist. The evolution of Dr Thyagarajan as a professional in the domain of scientific research occurred in many phases. His was an evolution which revealed multi-dimensionality and in multiple planes. He was initiated as an organic chemist in a work environment of industrial research, His organic growth as a professional researcher rendered him into a coordinator of multi-institutional projects and programs connecting CSIR laboratories to national causes of technological needs for manufacture of agrochemicals. His unqualified success as a research coordinator led to his elevation as the Director of the then Regional Research Laboratory in Jorhat at the young age of 40.

Lateral Transition from One Regional Research Laboratory to Another: Jorhat to Hyderabad: Success of the Directorship of Dr GT at RRL. Jorhat led to the change of scene from Jorhat to Hyderabad as Director of the then Regional Research Laboratory (RRL-H). Tasks were larger. Team sizes were bigger. Challenges were harder. The leader was stronger than the tasks. It was a period of change for the RRL Hyderabad. The laboratory undertook challenges in technology development needed in a host of chemical industries in the country delivering Intellectual Properties with Technology Readiness Levels beyond 5 and 6. Detailed Engineering packages became parts of Technology Transfer Agreements in RRL Hyderabad. The institute emerged as a dependable name in the chemical sector in the country. A New brand name for RRL-H in the chemical sector was being built. Today RRL-H has transformed into Indian Institute of Chemical Technology not just by change of name, but by absorbing a cultural change and undergoing metamorphosis. In this transformation of RRL-H, Dr AV Rama Rao who succeeded Dr Thyagarajan made stellar contributions.

Emerging as a Go To Man of CSIR: Dr G Thyagarajan fondly referred to as GT among colleagues of entire Council of Scientific and Industrial Research had become Go-To man. There were numerous committees chaired by Dr Thyagarajan during 1980-83 for CSIR. His comprehensive understanding of issues in an intramural research agency like CSIR came to be called in for dealing with multidimensional issues relating to technology development and commercialization.

Transition of A Go-To man into A Man with Golden Touch for Leather Sector: Dr G Thyagarajan: The reputation of Dr G Thyagarajan as the Go-To man of CSIR at times of needs was called in when Central Leather Research Institute, Chennai required leadership changes for ushering Indian leather industry into a new Future. The acronym GT for Dr G Thyagarajan became synonymous with Golden Touch of the leader. The Go To man of CSIR became soon the Midas of the Indian leather industry with Golden Touch.

Spokesman for Risk mitigation and Industrial Safety: While he was serving as the Director, CLRI, he invested trust, energy and foresightedness into developing a sustainable leadership pipeline. He used the fundamental principles of delegation of authority, empowerment in decision making and trust in his deputies. Such style of functioning in CLRI also permitted him to devote time on national issues including the handling of the after math of the Bhopal disaster. He became soon the champion of industrial safety and led the national movement to build human capacity in risk assessment and mitigation. CLRI founded one of the earliest "Cells for Industrial Safety and Risk Assessment" during his tenure.

Transition of a Scientist into a Science Diplomat: GTs evolution from research leader in CSIR environment into change manager in areas of national needs became apparent. State craft of Dr GT earned him friends, accolade and admiration not only from science community but also from civil servants and diplomats. Science diplomacy traits of Dr GT earned him the role of Secretary Commonwealth Science Council in London for a period of three years with lien from CSIR. He carried himself into the role of science diplomat with aplomb.

Champion of the Cause of Science for Small Nations: The stature of Dr G Thyagarajan as science diplomat soared high. He had grown in stature across the globe. He could have stayed on and switched careers, but he chose to return to CLRI and hold the mantle for the remainder of his service at CSIR. His later career was centered around science for small nations and developmental needs of low-income countries. Metamorphosis of an organic chemist into a research leader, a research leader into an architect of leadership pipeline, an architect into science diplomat and diplomat into champion for science for the unreached nations are all parts of multi-dimensional aspects of a live well lived.

Making of an Organic Chemist

Dr GS Sidhu[$]
Prof M M Sharma[$]
Dr T Ramasami

[$]Extracted from edited volume brought out in 1994



Rajan: A Chemist, a Leader and a Patriot

(Extracted from Tribute published in 1994)

Dr GS Sidhu, Ex. Director-General, CSIR, 29, P & T Colony, Secunderabad 500 003

My association with Dr G Thyagarajan goes way back to 1956. After a brilliant scientific career, he Joined the RRL, Hyderabad, to work towards his Ph.D. Professor S. Husain Zaheer, the Director of the Institute (and my teacher), placed Rajan with me under his overall supervision. I discovered very quickly that Rajan was an exceptionally bright young man. He needed minimal help by way of direction and no supervision. He showed an independence of approach, was able to define his end objectives and chalk out alternative approaches to reach his goals. He pursued his work with single minded devotion and yet found time to engage in some of the important extracurricular activities of the Institute. Lest this become too much of a panegyric, let me add that though a sportsman in the true sense of the word, he showed no prowess at all in the sports field.

It might be worthwhile to recall that his earlier work was in the synthesis of some heterocyclic molecules. The aim was to synthesize compounds which could be potential tranquilizers, analgetics or hypnotics. The knowledge and understanding of structure activity relationships was not so advanced at that time and yet he was able to synthesize a series of compounds, some of which showed very promising tranquilizing activity. After extensive pharmacological evaluation in animals in USA one of these was slated for trials in human volunteers, but was given up on commercial considerations by the US Company. They decided that even after successful trials in humans, the promotional costs would be too high.

During a visit to USA, I happened to talk to Prof Henry Rapoport in Berkeley about some of Rajan's work. Soon after that Prof. Rapoport offered him a postdoctoral position. He did so well there, that he was followed by Bhale Rao and Iftikhar later. A stint with NIH in Washington followed later. The work on pesticides in RRL, Hyderabad was initiated and directed by him and is still a major revenue earner for the institute. By now his managerial qualities also came to the fore and he was appointed Director of the RRL, Jorhat at the relatively young age of 40 years.

It is a tribute to his qualities of leadership and organizing ability that RRL-J was transformed rapidly into a pulsating, thriving research institute, contributing not only industrial processes but also publishing quality research papers in Organic Chemistry.

For me it was a matter of great pleasure and pride, when he succeeded me as the Director of RRL, Hyderabad. There was great pressure to change the name of the laboratory as it was felt that the name 'Regional' does not reflect the 'National' character of the Institute. As the then Director General, I asked him, if he would like the laboratory renamed, but he preferred to keep the name as such and said that the reputation does not depend upon the name.

It was later a very good decision on the part of, Dr. S. Varadarajan, as Director-General, to ask Rajan to lead the CLRI. For a person, totally new to leather, it was nothing short of a miracle, not only to check the downslide of this prestigious institute, but to put it on a path of rapid progress. The glory of Prof. Nayudamma was not only fully restored, but also new and modern disciplines were introduced, nurtured and fostered. Today with the new blood infused into it by Rajan, CLRI stands out as one of the very best CSIR institutes, with a reputation that transcends national boundaries.

His tenure as Secretary of the Commonwealth Science Council and Scientific Adviser to the Secretary-General of the Commonwealth Science Council from 1987 to 1990 was outstandingly successful. This tenure originally for two years, was not only extended as an exception to four years, but the Secretary General was keen that Rajan serves in London, till his retirement age from CSIR. Yet he chose to return to serve the mother country. All kudos to him.

I am proud of Dr Gopalakrishna Thyagarajan and salute him.

Dr. Thyagarajan

(Extracted from Tribute published in 1994)

Prof M M Sharma, Director, Department of Chemical Technology,
University of Bombay, Bombay 400 019

Dr G Thyagarajan, GT to many of us, is dynamic in whatever he takes up. My own interactions started some twenty years ago while he was at Jorhat. I was impressed with his uncanny abilities to catapult that RRL into the national scene in an effective way. He possesses a very pleasant personality and his methodology is to be persuasive. His participation in the programme on agrochemicals has made a decisive impact in the country. It was clear to me, all along, that he Is willing to take-up challenges and work even in unchartered areas.

The return of the 'native' to the then RRL, Hyderabad (now IICT) made yet another impact and the laboratory attained greater heights. My association as the Chairman of the Research Advisory Council brought us closer and I could discern his interest in bringing up the catalysis, oils processing, etc. divisions so as to bring them closer to industry. His attitude has been to look for solutions rather than take solace in pointing out supposedly insurmountable problems. He is always agile and you cannot have a dull moment with him.

His versatility saw new encounter with leather at the CLRI. Madras. I distinctly remember my discussions, as a member of the CSIR Review Committee, about the dire need to bring industry sponsorship on a professional base. Once again, I saw GT in action and sure enough CLRI was bubbling with enthusiasm. The foray in London with the Commonwealth Science Council (CSC) added the international touch to his personality. The somewhat dormant work of the CSC was jolted into vigorous action and I had clear glimpses of his desire to assist small commonwealth nations as I had participated in the exercises in Brunei and Mauritius.

GT has helped many individuals in so many ways and it was really cruel when his domestic servant attacked him and his wife. It must be the stock of his good deeds that pulled him out of that horrible episode. That is GT. I am sure he will continue to have forays in unchartered areas and show his abilities in altogether different ways.

Journey of a Chemist in Dr G Thyagarajan

as narrated by Dr T Ramasami

Early stages: Dr G Thyagarajan was initiated into research through work on heterocyclic chemistry. Tetrahydroquinoline derivates find extensive applications in medicinal chemistry. Synthesis of derivates of tetrahydroquinoline had remained an active area of research in the later fifties and sixties in view of their applications in synthesis drugs. Typically catalyzed hydrogenation of quinolines was a general approach. In view of the reversibility of hydrogenation, strategies were designed to overcome the reversibility challenge. Synthesis of alkoxy and alkyl substituted 1,2,3,4-tetrahydroquinoline published in Nature 1962 by G Thyagarajan in collaboration with GS Sidhu and SH Zaheer opened up his scientific profile. Some of the compounds he synthesized with heterocyclic residues as substituents exhibited interesting biological activity.

A new synthesis of 1,2,4,6 tetrazepines and many drug intermediate and feedstock have been the focal theme of his early research as a synthetic organic chemist. His research was by and large on heterocyclic chemistry.

A generic procedure for involving cyclization of Amino and methyl amino propionic acid followed by esterification and dehydrogenation was developed for synthesis of substituted imidazole.

Mid-career Stages: His review published in co-authorship with Bhattacharya in Chemical reviews in 1981 on Michaelis- Arbuzov rearrangement has remained a citation classic.

Isolation and characterization of flavones, flavonoids from natural products in collaboration with natural product chemists have been focal theme of his research in mid-career. Design and Development of clay anchored catalysts for syntheses of designed organic compounds formed the basis of his research in midcareer.

Concept to commercialization of some chemical products for applications in various industries became the central theme of his research. His work pertained to applications of chemistry in pharmaceutical and agrochemical sectors.

Later-career stages of a chemist: Use of Water hyacinth for applications of paper manufacture, assuring industrial safety in chemical sector, modernization of leather processing activity, technological developments for leather and allied chemical sectors were focal themes of his research in later part of his professional career.

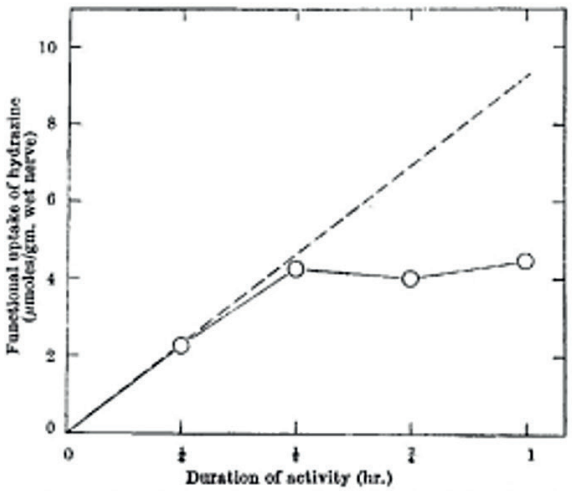

Fig. 1. Functional uptake of hydrazine based on data in Table 2

sodium/hr. activity/gm. wet nerve; a value in agreement with the extrapolated gain in HZ due to activity. The observations suggest that, during activity, HZ replaces sodium quantitatively but is not 'pumped out' as sodium is under normal conditions.

There is no difference between the amounts of protein-'bound' HZ of resting and stimulated nerves. The 'bound' HZ content of 40 nerves was found to be 87·9 ± 33·9 mμmoles/gm.

The extra functional uptake of 4·5 μmoles is only 10 per cent of the initial internal content of 45 μmoles when the nerve was soaked overnight in HZ-Ringer's solution; but apparently is more injurious to nerve activity than the latter. The interpretation of these observations remains, at this moment, obscure. It is not known if the actual maintenance of function by HZ is mediated through a slow release of ammonium ions which cause the nerve to fail irreversibly.

This work was supported in part by a grant (*B*–226) from the National Institute of Neurological Diseases and Blindness of the National Institutes of Health, U.S. Public Health Service. I am indebted to Dr. H. Waelsch for his encouragement and interest throughout this work, and acknowledge the advice of Dr. R. Lorente de Nó.

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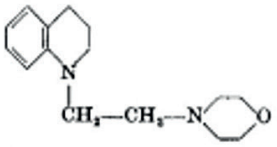
[1] Lorente de Nó, R., Vidal, F., and Larramendi, L. M. H., *Nature*, **179**, 737 (1957).
[2] Leach, S. J., and Parkhill, E. M. J., *Proc. Intern. Wool Textile Res. Conf.*, *C*92 (1955).
[3] Watt, G. W., and Chrisp, J. D., *Anal. Chem.*, **24**, 2006 (1952).
[4] Keynes, R. D., *Proc. Roy. Soc.*, B, **142**, 359 (1954). Shanes, A. M., and Berman, M. D., *J. Cell. Comp. Physiol.*, **45**, 199 (1955).
[5] Hurlbut, W. P., *J. Gen. Physiol.*, **41**, 959 (1958).
[6] Cheng, S-C., *J. Neurochem.*, **7**, 278 (1961).
[7] Asano, T., and Hurlbut, W. P., *J. Gen. Physiol.*, **46**, 1187 (1958).

PHARMACOLOGY

New Potent Tetrahydroquinoline Derivative

In connexion with work on tetrahydroquinoline derivatives of medicinal interest, we have recently synthesized a number of alkoxy- and alkyl-substituted 1,2,3,4-tetrahydroquinolines[1] in which various dialkylaminoalkyl groups (carrying in some cases heterocyclic residues such as morpholino, piperidino, etc.) are linked directly to the nitrogen atom. Among the compounds tested so far, *N*-[2-(4-morpholino) ethyl]1,2,3,4-tetrahydroquinoline (I) has shown interesting biological activity.



(I)

Tests carried out with (I) on mice following single oral doses of 126 mgm./kgm. (LD_{50} = approximately 1,000 mgm./kgm.) administered as the hydrochloride demonstrated that (I) significantly elevated the electro-shock-seizure threshold. Elevation of the electro-shock-seizure threshold was of the same order of activity as 2-methyl-3-orthotolyl-4-quinazolone synthesized in this Laboratory[2]. The median protective oral dose of (I) which prevented the extensor phase of electro-shock-induced convulsions in mice was 270 mgm./kgm. of the hydrochloride (95 per cent confidence limits: 225–346 mgm./kgm.). The median protective dose of 2-methyl-3-orthotolyl-4-quinazolone against electro-shock-induced convulsions was 68 mgm./kgm. (95 per cent confidence limits: 51–89 mgm./kgm.). An oral dose of 200 mgm./kgm. did not reduce the conditioned avoidance response in conditioned rats. Mice treated with (I) exhibited ptosis which was reminiscent of reserpine activity. The vasodepressor activity of (I), intravenously applied to acute dog preparations, gave only transitory lowering of blood pressure at a dose-level of 4 mgm./kgm.

Like reserpine[3], (I) antagonizes muscle spasms induced by histamine. On isolated smooth muscle of different species, (I) consistently antagonized acetylcholine effects also. Spasms induced by barium were also reduced by (I) in rat and rabbit ileum, but, in contrast to reserpine, were enhanced in guinea pig ileum. The results obtained indicate that, as far as these preparations are concerned, (I) does not appear to act on specific receptors but may be acting myogenically. This suggestion is supported by the observed ability of (I) to stimulate the nerve-free smooth muscle of chick amnion and the inability of atropine to block the stimulating effects of (I).

Compound (I) was prepared by condensing freshly prepared morpholinoethyl chloride with 1,2,3,4-tetrahydroquinoline. It was distilled as a heavy, pale yellow oil, b.p. 185–188° C. at 3 mm. (found C, 73·35; H, 9·12; N, 11·40; required C, 73·12; H, 9·00; N, 11·37). It is soluble in organic solvents but insoluble in water. For pharmacological screening the hydrochlorides were also prepared: the dihydrochloride, m.p. 166° C. with decomposition (found N, 8·70; required N, 8·77); the monohydrochloride m.p. 203–7° C. (found N, 9·65; required N, 9·87). These salts are freely soluble in water.

The pharmacological screening was carried out by workers in the Strasenburgh Laboratories, Rochester, New York, to whom we express our thanks.

G. S. Sidhu
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[1] Thyagarajan, G., Sidhu, G. S., and Zaheer, S. H., Indian Patents 70175 and 76681.
[2] Kacker, I. K., and Zaheer, S. H., *J. Ind. Chem. Soc.*, **28**, 344 (1951).
[3] Gillis, C. N., and Lewis, J. J., *J. Pharm. Pharmacol.*, **8**, 606 (1956).

The Michaelis–Arbuzov Rearrangement

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Contents

I. Introduction

The Michaelis–Arbuzov rearrangement, also known as the Arbuzov rearrangement, Arbuzov reaction, or Arbuzov transformation, is one of the most versatile pathways for the formation of carbon–phosphorus bonds and involves the reaction of an ester of trivalent phosphorus with alkyl halides. The reaction, originally discovered by Michaelis[1] in 1898, was explored in great detail by Arbuzov[2] and several subsequent investigators. The rearrangement is one of the most thoroughly investigated among organophosphorus reactions and is widely employed for the synthesis of phosphonates, phosphinic acid esters, and phosphine oxides.

In its simplest form the Arbuzov arrangement is the reaction of an alkyl halide with a trialkyl phosphite, yielding a dialkyl alkylphosphonate (1). Thus, during

1

R = alkyl, aryl, etc.
R' = alkyl, acyl, etc.
hal = Cl, Br, I

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Alok Bhattacharya was born in Dacca, (undivided) India, in 1942. He took his Ph.D. in synthetic organic chemistry in 1967 from Banaras Hindu University. He went to Canada for further studies and from 1968 to 1970 worked in the University of Regina and McGill University, Montreal. After a few years of teaching graduates and undergraduates, he joined the Regional Research Laboratory, Jorhat, India, as a scientist and worked there on organophosphorus compounds and industrial chemicals. He is presently with Hindustan Insecticides Limited, New Delhi, doing pesticide research.

Gopalakrishna Thyagarajan is director of the Regional Research Laboratory in Hyderabad, Andhra Pradesh, India. Born in 1934, he received his Ph.D from Osmania University, Hyderabad (1963), and did postdoctoral work with Professor Henry Rapoport at the University of California, Berkeley (1964–1965). He was Visiting Scientist (1969–1971) at the National Institutes of Health, Bethesda, MD, in the laboratory of Dr. Everette L. May, NIAMD. His interests in organic chemistry relate to heterocyclic synthesis, chemical examination of Indian flora, and development of manufacturing knowhow for pesticides, drugs, and industrial organic chemicals. He served earlier (1975–1980) as director of the Regional Research Laboratory, Jorhat, Assam.

the transformation a tervalent phosphorus (P_{III}) is converted into a pentavalent phosphorus (P_V). In general, the alkyl group of the halide gets attached to the phosphorus, and one alkyl from phosphorus combines with halogen to form the new alkyl halide.

The rearrangement has been discussed in a book on organophosphorus compounds[3] and in two reviews[4,5] dating back to 1964. To date there is no available review of the subject in English, though several have

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Transition of an Organic Chemist into a Director of CSIR laboratory

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[$]Extracted from edited volume brought out in 1994







Remembering Dr G. Thyagarajan

Virendra M. Tiwari, CSIR-Outstanding Scientist and JC Bose National Fellow,
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Assam, India

I feel privileged to be asked to pen down a few lines in the honor of Dr G. Thyagarajan, who served as the Director of CSIR-North East Institute of Science and Technology (CSIR-NEIST), erstwhile RRL, Jorhat from 1974 to 1981 and contributed seminally for the progress of the CSIR-NEIST. We, the CSIR-NEIST community do solemnly acknowledge with a deep sense of gratitude the exemplary services he had rendered with great devotion and scientific directions he has provided to this hallowed institute in particular and the CSIR as a whole. During his leadership, this institute witnessed a sea change in the sophistication of infrastructure for advance research. The prolific researcher in him has manifested in itself a mosaic of diverse contributions in the arena of modern science and invaluably contributed as an investigator of many prestigious projects. To name a few from the multitude of his contributions is indeed a difficult task, but in nutshell Dr Thyagarajan played a pivotal role in paving the foundation of the modern CSIR-NEIST, Jorhat. Dr Thyagarajan was instrumental in creating the sub-stations at Nagaland and Manipur. The campus saw lots of infrastructure development during his tenure; mention may be made about the present-day modern auditorium building of CSIR-NEIST, the foundation stone of which was laid during his administration. Under his stewardship the laboratory scripted a phenomenal growth and success story in terms of R&D and translational research. There are many noteworthy achievements, but, I would like to mention a few. A Fluidized bed combustion unit, designed, fabricated and was installed in collaboration with BHEL, New Delhi. A pesticide pilot plant was installed in the RRL campus. The flow improver Pilot Plant was installed in the institute. RRL-Jorhat conducted in-plant study of Caffeine Plant for Assam Pharma Co., Jorhat. The paper slate manufacturing unit was installed at the Yaongyimsen village of Nagaland by the then RRL and imparted training to the local Naga boys. The Citronella distillation unit was installed at Yaongyimsen village of Nagaland offered by RRL-Jorhat on Turn-key basis. Phosphamidion, an organophosphorus pesticide was developed and a pilot plant was installed. Mass spectrometer-gas Chromatograph (MS-30) was installed in the laboratory. During his tenure the erstwhile Geoscience Division was facilitated and the division came out with detailed studies on seismicity and geodynamics of North East India. A multipurpose pilot plant was installed for carrying out studies on various processes of Chemical Engineering. RRL-Jorhat signed a tripartite agreement with NRDC and M/s Benquett Electric Corporation of Philippines on 27 October, 1977 for release of the knowhow "paper boards for use in building and construction works" developed jointly by RRL-Jorhat and CBRI-Roorkee. Other processes, technology and products which came out during Dr Thyagarajan's tenure include plastic slates manufactured by Mariappa Entreprise, Tamil Nadu using RRL technology, an improved coating composition for making paper slates from straw boards and paddy husks bricks were also developed. The Chloro choline chloride-a plant growth regulator pilot plant was established. Seismic monitoring station was installed at Yaongyimsen village in Nagaland. A pilot plant for Chlorfenvinphos, (an effective pesticide) was developed and installed. This technology was transferred to

the National Organic Chemical Industries Ltd., (NOCIL), Bombay. The first commercial plant (1200 tpa capacity) in India based on RRL-Jorhat technology for beneficiation additive was installed by Allied Ressins and Chemicals Ltd., Calcutta. A commercial plant was installed by Hico Products Ltd., Bombay based on RRL-Jorhat developed technology on oil well cement additive. The RRL-Jorhat technology on VSK mini cement plant was transferred to Kutch Cement Pvt. Ltd. and the cement plant came up in Kutch, Gujarat. Under his stewardship RRL-Jorhat developed Jor Lab C-2: An improved strain of Java Citronella grass. A matrix board commercial plant was installed by Usha Paper & Board Industries, Faridabad based on RRL-Jorhat technology. A detailed engineering package for VSK mini cement plant for turn-key offer was prepared in collaboration with M/s FEDO, Cochin. The laboratory underwent international collaboration for management of Water Hyacinth (Eichhornia crassipes) which was sponsored by the Commonwealth Science Council under its Rural Technology Program and financed by United Nations Environment Programme (UNEP). The laboratory developed various grades of handmade paper from water hyacinth and digester for biogas production from water hyacinth. Flow Improver SWAT-104 for tackling crude oil flow problems was developed under his able leadership. The laboratory also designed a detailed information package for Citronella distillation plant of 1000 kg/batch capacity which was handed over to Hocitril Distillation Co., Makum (Assam) for commercial exploitation. The laboratory established molecular sieves pilot plant to produce Type A and Type X molecular sieves from paddy husks which find a lot of applications in the petro-chemicals and gas industries.

Sub Station at Yaongyimsen village of Nagaland. RRL staff visiting the Station

Dr G Thyagarajan, then Director, RRL Jorhat and his wife Ms Shyamala Thyagarajan at the Sub Station at Yaongyimsen village of Nagaland.

Some of the notable personalities who visited the institute during his tenure are Dr Raja Ramanna, Director, Bhabha Atomic Research Centre, Bombay, Dr SK Zlatev, Bulgarian Scientist under Indo-Bulgarian joint sub-commission for scientific and technological cooperation. Mr Maynard, British Deputy High Commissioner also visited the laboratory. Other dignitaries who visited the laboratory in his tenure include, Dr Cyril Poonamperuma, Professor, Department of Chemistry and Director, Laboratory of Chemical Evolution, University of Maryland, USA; Mr George Fernandes, the then Union Ministry of Industries; Sir John Thompson, British High Commissioner in India and Lady Thompson; Prof. H. Gunther from University of Seigon, Germany and Lady Gunther under DAAD-CSIR exchange programme; Mr Robert F. Goheen, American Ambassador to India. Prof. S. Nurul Hasan, the then Vice President of CSIR, formally inaugurated the semi-commercial Chlorfenvinphos (CFVP) pilot plant on 19 November 1980.

The first course on financial management for R&D under CSIR Management Development Programme was held at RRL during 10-18 January in1977 which saw the participation of delegates from all other CSIR laboratories. Dr Thyagarajan was proactive to rope in industry for translational research. A research and industry get-together was organized by the then RRL at Guwahati on 3rd May 1975 in collaboration with ASIDC, SISI and Directorate of Industries, Govt. of Assam and Prof. Y Nayudamma, DG CSIR was also present on the occasion. Dr Thyagarajan organized Futurology Workshop on "Alternative Futures-Application of Science & Technology on North East tribal and hill areas development in the next 25 years". The workshop was attended by Dr S.C Seth, member Secretary, NCST panel on Futurology, DST, Govt. of India, Mr L.P Singh, Governor NE states, Mr S.K Roy, Former Ambassador of India to Mexico. Dr Thyagarajan was instrumental in organizing the 22nd Annual Convention of Essential Oil Association of India in RRL-Jorhat during 12-13 February, 1979. Dr G. Thyagarajan was a towering personality and because of his dynamic persona, he represented the DG CSIR in the 11th Biennial of Common Wealth Science Council (CSC), London held in Nairobi during 15-26 September, 1980. Very recently, I had opportunity to meet and talk to him when he was visiting, CSIR-IICT, Hyderabad.

Today, we are reaping the rich dividends of the seeds sown by this great soul which is nurturing our future. I believe that his illustrious & impeccable scientific odyssey and his persona stand tall and will guide the young generations to abide by his values and virtues. At this juncture we recall the words of Denis Waitley that "Happiness cannot be traveled to, owned, earned, or worn. It is the spiritual experience of living every minute with love, grace and gratitude" and these words truly echoes his sagacious, sanguine and affable disposition which were the hallmark of his persona. We pray with folded hands to the almighty that let he keep you in peace to eternity in your heavenly abode and may all your cherished unfulfilled dreams come true. Let your family, near and dear ones remain blessed and cheerful for the years to come.

Dr G Thyagarajan and Regional Research Laboratory, Jorhat

(Extracted from Tribute published in 1994)

Dr Anil C Ghosh, Director, Regional Research Laboratory, Jorhat 785 006

Dr G Thyagarajan left an indelible mark of distinction on the image of the Regional Research Laboratory, Jorhat and could carve a distinguished place for it on the R&D map of the country. There are people who win the heart of others in their short stay at a place. So is the case with Dr Thyagarajan. Dr Thyagarajan joined this laboratory on 30 Dec 1974 and left on 30 Jan 1980 to take over the Directorship of Indian Institute of Chemical Technology (the then Regional Research Laboratory, Hyderabad). Though his stay at RRL, Jorhat was short, it attained a distinguished position by the time he left it. During his tenure, the laboratory witnessed all- round progress and was honored by the prestigious FICCI award. Our laboratory was fortunate to have such a dynamic personality as a director.

On taking over the directorship of the laboratory Dr Thyagarajan reoriented the research programs and vitalized the activities of this laboratory. He was instrumental in accelerating the work on rural technologies based on medicinal and aromatic plants of North East India, utilization of agro-waste, low cost-housing as well as development of technologies in paper and pulp. To interact directly with the rural people, he provided intensive consultancy services to the parties for cultivation of medicinal and essential oil-bearing plants, distillation stills for citronella, building materials, soil engineering and supply of improved varieties of planting materials. It is because of his pioneering and untiring efforts today this region has about 6000 acres of land under citronella cultivation. Under his able guidance several technologies were developed and released to various parties for commercial exploitation. Notably among those are Phosphamidon, Quinalphos, Chlorfenvinphos, Glyphosate, Vapam, Phosmet, additives for iron ore purification etc. The re-standardization work on chloroquine phosphate for M/s Bengal Immunity Company limited and Caffeine from tea waste for M/s Assam Phanna Co., Jorhat was also completed under his dynamic leadership. Another success of the laboratory under his leadership was the commercial exploitation of Vertical Shaft Kiln technology (VSK) to produce Portland cement.

Dr Thyagarajan is a great visionary and a futurist. While he was here in Assam, he fully realized the topography of this region which is bestowed with abundance of natural resources like petroleum natural gas, coal, minerals, tea as well as the flora and fauna. He put his best effort to make effective use of this immense natural wealth. He gave new direction to many research programs including isolation of active principles from plants and the problems related to transportation of high waxy crude oils. Many new compounds were isolated from plants of this region and were characterized. Some of these were having novel skeleton and possessed marked antifeedant property. Similarly, he took keen interest in the development of oil field chemicals - such as flow improvers used in transportation of high waxy crude oils from different parts of the country. Dr Thyagarajan made substantial and valuable contribution throughout his stay in Assam and that brought both name and fame to this laboratory. international collaboration also Dr Thyagarajan had the distinction to be the Regional Coordinator of the inter- country collaborative project on management

of water hyacinth sponsored by United Nations Environment Programme (UNEP) and Commonwealth Science Council (CSC), London. It was his idea to convert the aquatic weed into resourceful materials. The work on water hyacinth was highly commended and cited during the 11th Biennial Meeting of CSC held in Nairobi on 15 Sept 1980.

Dr Thyagarajan is loved and respected by the staff and their families of RRL, Jorhat for his charming qualities, his abilities to provide leadership and his futuristic, scientific, and forward-looking mind. During his stay at RRL, Jorhat all staff members as well as their families always held Dr & Mrs. Thyagarajan in high esteem for their congenial temperament, tolerant habit, social nature, and sincere desire to help people. His qualities of conciliating gestures are always appreciated and talked. He has tremendous love for this region and never misses any opportunity to visit Assam. In one of his recent visits to this laboratory he mentioned that one may take him out of Assam but Assam will never go out of his heart. His unstinting hard work, dynamic vision and capacity to take challenges have given him the honor, which he is commanding today. We all wish him for continued success and long life.

Dr G Thyagarajan: A Legendary Leader with Beacon of Knowledge

D. Ramaiah, Birla Chair Professor, Department of Chemistry, BITS Pilani,
Hyderabad & Formerly Director CSIR-NEIST, Jorhat

On the occasion of release of 'REMINISCENCES' as a part of the 90th Birthday celebrations, it is with great love and affection that I pay my sincere respects and tributes to late Dr G Thyagarajan, a legendary leader with beacon of knowledge. Dr Thyagarajan was a distinguished educator, illustrious researcher, and successful Director of the three CSIR Institutions. In the course of time, he left behind a legacy of excellence and passion, which has become inspiration to many of us.

It was during the end of 2013 and after I took over the charge as the Director of the CSIR-North East Institute of Science and Technology (CSIR-NEIST), Jorhat, I had an opportunity to meet Dr Thyagarajan, personally, at the CSIR-Indian Institute of Chemical Technology (CSIR-IICT), Hyderabad. Of course, I learned many, many facets of him before and also his immense contributions to the CSIR through several friends and well-wishers including Dr T Ramasami and Dr P G Rao.

Memories recorded in 2014 during the National seminar jointly organized by IICT, CLRI and NEIST to Commemorate 80th Birthday celebrations of Dr G Thyagarajan at the CSIR-IICT, Hyderabad

When I met Dr Thyagarajan, for the first time in Hyderabad, I was truly impressed with his dedication and commitment to the CSIR organization in general, and the Institutions that he had served over three decades, in particular. Thus, this interaction, which was very special, and had a huge impact on my future course of actions that followed at the CSIR-NEIST, Jorhat. Dr Thyagarajan was a man of simplicity and emboldened with humanity. He had the unusual ability to connect with the people and the organizations as well as with the colleagues and friends on both personal and professional levels.

Dr Thyagarajan served as the 3rd Director of the CSIR-NEIST (then RRL, Jorhat) from 1974 to 1981. After successfully completing his term at Jorhat, he served as the Director of both the CSIR-IICT, Hyderabad and the CSIR-CLRI Chennai, and thereby gained a unique distinction of having served the three premier CSIR Institutions. As a director at the then RRL, Jorhat, Dr Thyagarajan was instrumental for the exemplary contributions of the Institute to both basic as well as industrially oriented research activities. He laid a strong foundation and the Institute soon became a centre for the interdisciplinary research activities, wherein successful active collaborations were initiated across the divisions in the Institute. Dr Thyagarajan was a visionary and exposed the Institute to the National and International peer reviewers in the chosen areas of interest and also encouraged the colleagues to interact with the pioneers within India and abroad.

Dr Thyagarajan was an inspirational leader and continued his close association with the colleagues of the RRL, Jorhat until recently. Importantly, he also served as the Chairman, Research Council (RC) of the Institute during the years 2003 to 2009, when Dr P G Rao was the Director. The Institute has made significant progress in this period of time and contributed immensely to both high quality science and the development of affordable technologies. To commemorate these developments, the Institute was honored with the CSIR technology awards and national recognitions. Incidentally, the name of the Institute was also changed from the Regional Research Laboratory (RRL) to the North East Institute of Science and Technology (NEIST) in 2007, when Dr Thyagarajan was the Chairman of the Research Council.

It was a great honor for me to inherit a great legacy and had the wonderful opportunity to serve the CSIR-NEIST, Jorhat from 2013 to 2018. The Institute, which was well-reputed and a house-hold name in the entire North East region soon received a global ranking of 556th among 5250 Institutions and 15th best R&D Institute in India as per SCImago rankings in 2017. I take this opportunity to express my sincere thanks and appreciations to all my predecessors including Dr G Thyagarajan, for their dedicated efforts and contributions. What the CSIR-NEIST today is because of the strong foundation, that was laid by its visionary leaders and stalwarts like Dr G Thyagarajan, several decades ago.

The sudden demise of Dr Thyagarajan was a great loss to the scientific community, in general, and the CSIR organization, in particular. I pray Almighty for the departed soul rest in peace and hope the legacy of Dr Thyagarajan will continue to inspire the generations of youth and scientists of this country. Om Shanti.

My Journey with Dr G Thyagarajan - An Excellent Dynamic Leader and a true Mentor

Dr PG Rao, Former Director, CSIR- North East Institute of Science & Technology, Jorhat, Assam, India

The Beginning…

As I sit down to write this memoir, responding to Dr KJ Sreeram's request, memories flash back to 1976, to the day I arrived in Jorhat, to take up the post of Scientific Assistant offered to me in the Chemical Engineering Division of Regional Research Laboratory (RRL) under the sparkling leadership of Dr K V Raghavan (KVR), with Dr G Thyagarajan (GT) as the young Director of the Laboratory, who had embarked on building and equipping a state-of-the-art facility for chemical process development. RRL, Jorhat was a key player in the multi-institutional R&D programme of CSIR on pesticides to complement the Green Revolution already launched in the country under the able leadership of Dr GT. I joined the youthful team invigorated by the national cause, for Process Development, Scale up and Design. Tasks assigned to Jorhat were admirably completed, putting RRL, Jorhat firmly in the national compass, under the able Directorship of Dr GT.

Dr PGR with Dr GT in pilot plant

From the beginning, my career was closely followed by Dr GT, along with my principal mentor, Dr KVR. His orientation made me to look at things with a positive attitude, which helped me to reach what I am today. During that time, I had the opportunity to observe his brilliant qualities of professional and personnel integrity, organizational acumen, team building and coordinating, dynamism infused into humility, humane approach to human issues, and endearing personal qualities, all under an overarching character of **'leading by example'.**

The Change…

Subsequently, Dr GT moved to Indian Institute of Chemical Technology (IICT), Hyderabad as Director, after completing his successful term at RRL Jorhat. There also, I had the opportunity to interact with him through the Agrochemicals and Oil & Gas projects, which were collaborative (in Network mode those days). In a subsequent development, he moved to CSIR-CLRI as Director, where he moved Dr KVR, Former Director, CLRI to strengthen the Process Engineering, Scale up and me for the Design Engineering facilities in leather processing in CLRI. He also introduced me to Dr T Ramasami, former Director, CLRI and Former Secretary, DST, with whom I had a long association and continued to receive mentorship from him. Dr GT conceived the idea and set up the Cell for Industrial Safety and Risk Analysis (CISRA), in CLRI, after the devastating MIC disaster in Bhopal. Being the very first venture of its kind in the country,

Pilot Scale Technology Transfer to Rallis India

CISRA was required to set standards and protocols involving engineering knowledge and operational skills of a very high order. The idea of Dr GT introducing the leather complex in Kolkata, by relocating the tanneries is a reality in today's time, the success of which lead to many more in the country. His brain child CISRA has made a big impact on the chemical industries across the country and many used the services of CSIR.

Back to where I began…

In 2002, when the position of Director RRL-Jorhat fell vacant, the then Director-General of CSIR, Dr RA Mashelkar sought DR GT's suggestion for a suitable person(s). Dr GT motivated me to go back to Jorhat, and proposed my name, relying on his personal knowledge of my abilities, and his conviction that Jorhat would gladly welcome me back. In the event, after due process, he was correct and I got the opportunity to move to RRL, Jorhat.

Heading and directing a CSIR kind of research institution calls for extraordinary talent and an unusual combination of skills and traits. Not everyone entrusted with that responsibility can cope with it and succeed. There have been outstanding performances and, also, miserable failures. Creativity flourishes and delivers in an environment, which encourages independence of mind. Many failures are attributable to intolerance on the part of the leader to conceding that precious freedom to differ. But Dr GT successfully completed his tenure in three CSIR labs, putting each of them on a higher pedestal from where he took.

For the North East Region, CSIR's presence in the shape of RRL Jorhat (now CSIR-NEIST) has meant a lot from its very inception in terms of public image and esteem, science-based economic development and human resource building, to name a few, to meet the needs of the member states and geared to the advancement of the Region. During my tenure at CSIR-NEIST, as Director, I was fortunate to have Dr GT as Chairman of my Research Council, which helped me to have his able guidance in taking forward the CSIR Lab in the North East. He also introduced me to Dr V Prakash, Former Director of CSIR-CFTRI, with whom I continue to have professional and personal guidance. When CSIR wanted to change the names of all the remaining RRL's at that time in the country to National or Indian Institutes, it was Dr GT's suggestion after consulting, staff and well-wishers to-coin the name "North East Institute of Science & Technology (NEIST)", keeping in mind the mandate of the Institute when it was setup. His suggestion was accepted by CSIR and appreciated by all. I was fortunate to be the Last Director of RRL, Jorhat and the First Director of CSIR-NEIST.

Dr GT's guidance and mentoring were always available to me from wherever he was, which helped me to significantly and hugely strengthen Science – Society interface. Dr GT is widely acknowledged as a highly successful performer, he leaves behind and, as well, carries with him a treasure of affection and goodwill from people where he worked and helped, and in particular his friends and well-wishers from the North East. Without hesitation, I can say the development of the North East was at the core of his heart.

On a personal note, I am proud that I had his blessings for over four decades in a variety of roles and modes. Dr GT's family and my own family have enjoyed warm and most pleasant relationships all along.

I pray to almighty for his soul to rest in peace.

A tribute to my Revered teacher, Mentor Dr G Thyagarajan

Dr Balagopalan Unni, FRES (London), FIANSc, FISAgBc, FICCE
Former Chief Scientist, CSIR-North East Institute of Science & Technology,
Jorhat, Assam, India

My most respectful teacher & Mentor who appointed me at RRL Jorhat, Dr G Thyagarajan is no more with us. Dr G Thyagarajan passed away on 24th March 2024 at his residence Chennai. This is very sad news for all of us, the entire CSIR family who served three CSIR laboratories in India as Director and for some time as Director General of CSIR too.

I heard the news regarding the passing away of Dr Thyagarajan from our CSIR-NEIST pensioners group. Dr Thyagarajan was my mentor and my respected teacher, and what I am today is due to his constant guidance and advice all through my scientific career. I started my job (Scientific research career) in 1979, first appearing for an interview at CSIR-NEIST (then RRL Jorhat) and then appointed at RRL Jorhat in 1980 to work in a project on water hyacinth funded by commonwealth council. London and Seven countries were involved in the project, and our lab RRL Jorhat was coordinating the project with Dr G Thyagarajan. I had no words to express at this moment about the wonderful research experiences I had during the project review meetings. Quite often we had it and at the time of the Research Council meeting too. I still remember another very important incident in my life. That was the time when he was our Research Council Chairman. Whenever he visits us, he always stays at our main suite of the guest house and that is called Brahmaputra. It was on the last day of the RC, and he was resting at our guest house. I still remember the time was around 5 PM. I got permission to see him. The reason for meeting him was for a nomination of mine for a Director position in one of the research institutes. He was very keen in collecting information from me. First, he asked about my family, my children and what stage they are at etc. I did not get any idea from such queries from him. But he reminded me that once you are going to be the director of any institute, you are the head and you should be free to act there without having any hindrance in your day today life. If you have no such major responsibilities from your family side, then you can run the institution very well. I still remember his very critical observations and one way it is very true. Such persons I have never come across in my life, and will never in future too.

Another quality I observed in his life about the style of his dress. Such a unique personality with very neatly dressed and the way he walks and talks with scientists, very different from others and that stands him away from other persons-a unique admirable quality. I still

remember those days he addressed the staff quite often and the comment in the English language is highly commendable and remarkable. I still remember once a newsletter was brought out by the commonwealth science council London, where the front page was Dr Thyagarajan's interview, he gave to the reporters at London regarding the progress of the project. His tenure as Secretary of the Commonwealth Science Council and Scientific Adviser to the Secretary-General of the Commonwealth Science Council from 1987 To 1990 was outstandingly successful. He also had an opportunity to serve as Director of three CSIR Laboratories (RRL-Jorhat, RRL Hyderabad and CLRI Chennai).

I still remember the day he visited my laboratory after his retirement from CSIR, and spent quite some time with me. He pointed out the best quality of a scientist and stressed more on hard work and sincerity. I retired from CSIR service on 31st Jan 2015 after 35 years of research career at CSIR-North East Institute of Science & Technology Jorhat, Assam. Appointed at Assam down town University as Director-Research in March 2015 and continued up to June 2019, and then re-designated as Adviser Research in August 2019. Back in Kerala, Dr. Unni is appointed as Director, Academic & Research at GEMS College of Arts & Science affiliated to University of Calicut from August 2019. Both the positions are on honorary basis to strengthen the institutions in research areas.

I continued to follow his advice in my day to day activities. Dr Thyagarajan was a very serious hard-working scientist specialized in chemistry, but not limited to chemistry, and he is an excellent manager, administrator too. He was a very good and very systematic and methodical observer at all levels and his observations are always very accurate. He used to take each and every step-in research work very seriously and the way he explained the most complicated matters in a very simple and lucid manner. I am very much impressed by his extraordinary management capabilities, commitment to science, dynamism coupled with vision, ability to unite people and institutions, respect for emerging sciences and genuine concern for the welfare of his friends and colleagues. RRL made a big and convincing splash in the area of pesticides - the organophosphorus and the organo chlorous varieties. Under his able guidance quite a number of technologies were developed and released to various parties for commercial exploitation. Notably among those are Phosphamidon, Quinalphos Chlorfenvinphos, Glyphosate, Vapam, Phosmet, additives for iron ore purification etc. The re-standardization work on chloroquine phosphate for M/s Bengal Immunity Company limited and Caffeine from tea waste for M/s Assam Pharma Co., Jorhat was also completed under his dynamic leadership. Together with RRL, Hyderabad and NCL, the Jorhat Laboratory, headed by Dr Thyagarajan brought the country to the point of self-reliance in the area of pesticides. This one development is a major contribution to the country, and the part played by him during his tenure was highly commendably significant. Another success of the laboratory under his leadership was the commercial exploitation of Vertical Shaft Kiln technology (VSK) for the production of port land cement. This technology was transferred within India and other countries too. He is a very good observer and never pretends that he knows everything. In fact, the contribution in the energy sector utilizing the water hyacinth during those days was highly remarkable, and our contribution was very well explained at all level Dr Thyagarajan's contribution is immense for the development of

CSIR in general and other CSIR Laboratories in particular, and it is not possible to explain in very few words.

Dr Thyagarajan was always loved and respected by the entire staff and their families of RRL, Jorhat for his charming qualities, his abilities to provide leadership and his futuristic, scientific and forward-looking mind. During his stay at RRL, Jorhat all staff members as well as their families always held Dr & Mrs Thyagarajan in high esteem for their congenial temperament, tolerant habit, social nature and sincere desire to help people. His qualities of conciliating gestures are always appreciated and talked about. He was also the person behind starting a recreation club at RRL campus. He used to arrange get together with officers from the Air Force and Army and other dignitaries at our campus, and that was always a special gathering. During that time, I was the secretary of the recreation club. He had tremendous love for this region and never missed any opportunity to visit Assam. Though he left Assam in 1981, quite often he visits the North East region, and whenever he visits the NE region, he never misses a RRL trip. In one of his visits to RRL Jorhat, he mentioned that" one may take him out of Assam but Assam will never go out of his heart". This statement was very true. I had interaction with his family members over phone, and once I talked with him during the Covid epidemic. He was quite alright while talking with me over the phone, and that was in 2020. Later on I was informed by his wife that he was facing a problem in replying to mail messages. Therefore, for my mail messages to Dr G Thyagarajan, his wife used to reply back on his behalf. Once I met his son Ravi at Hotel Blu Radisson, Guwahati after getting his contact number from Mrs. Thyagarajan. It is really a sad day for me, and I lost a great teacher of mine who guided me all the time. May his soul rest in peace.

My Homage to Dr G Thyagarajan

Dr R C Boruah, FNASc Formerly, Sc-H/Outstanding Scientist,
Acting Director & Emeritus Scientist, CSIR- North East Institute of
Science & Technology, Jorhat, Assam, India

It was in the beginning of August, 1976, when I had the maiden opportunity to meet Dr G Thyagarajan as Director, Regional Research Laboratory, Jorhat (RRL-Jorhat). Immediately after completing post- graduation in Chemistry from Dibrugarh University, I took up my PhD work under the supervision of Dr J S Sandhu, who later became Director, RRL-Jorhat during 1998-2002. As a research student, I found Dr Thyagarajan to be an adorable person who took keen interests on the research work of all research workers of the institute in general, and special attention to researchers of organic chemistry division, probably because of his expertise in organic chemistry. Many a times, he discussed research problem with PhD students in details and provided suggestions whenever necessary. In fact, my first research publication in 1979 in USA based Journal of Heterocyclic Chemistry was co-authored by Dr Thyagarajan as senior author. Another publication also appeared in the same journal after a year on heterocyclics synthesis with him.

Dr Thyagarajan owned a creative and visionary personality, who built a strong foundation of RRL-Jorhat as a multi-disciplinary laboratory comprising areas like chemical, biological, engineering, coal, petroleum, seismology, agro technology, plant sciences with two branch laboratories in Itanagar, Arunachal Pradesh and Imphal, Manipur. He was a dynamic and strict administrator with great discipline, punctuality and integrity. During his tenure, both applied and basic sciences started blooming. Several R&D works on drugs, pesticides, fungicides, agro technologies, seismic work, mini cement plant, flow improver of oil, low-cost house, bio-fertilizer, bio-exploration of oil, isolation of drugs from medicinal plants of North East etc. were carried and many technologies were commercialized. After joining CSIR as a Senior Scientific Assistant (SSA) in 1978, I started working on two in-house projects namely pentazocine (anti-inflammatory drug) and Captan & Captafol (fungicides). He built excellent facility for scale-up wok for R&D processes from laboratory to Pilot plant scale.

During his tenure, he invited many foreign professors to RRL-Jorhat for delivering scientific talks from their research field of expertise. That was a great boost to upcoming young researchers, which afforded them to visit abroad for higher studies availing fellowship under international programme like DAAD etc.

Dr Thyagarajan led a pool of senior scientists as HoDs in different disciplines, namely Dr J N Baruah, Shri B P Chaliha, Dr H D Singh, Dr K V Raghavan, Dr R K Mathur, Dr B K Saikia, Dr D N Bordoloi, Dr R C Rastogi, Dr J S Sandhu, Dr R P Sarmah, Dr M M Saikia, Shri U C Borah, Dr Balamoni Bezbaruah, Dr Bhaskar Rao and many others. He received strong support from all HoDs for creating a healthy atmosphere for the growth of RRL-Jorhat.

Dr G Thyagarajan was a wise and far-sighted manager who gave emphasis not only to applied research, but equally to basic research of important areas. In the beginning of his tenure, he employed active scientists like Dr J S Sandhu and Dr R P Sarmah, to initiate applied oriented basic research on synthesis and natural products from North East India. His intuition worked in later days, as these two scientists helped RRL-Jorhat to become more visible at national and international levels through their promising scientific contributions in medicinal chemistry and natural product chemistry fields. In following years, these two areas continued to contribute quality research by their students and co-workers. In addition to several national and state level science awards, the chemical science department also begged prestigious Fellow of National Academy (FNA) to Dr J S Sandhu and Fellow of National Academy of Sciences (FNASc) tor Dr J S Sandhu including myself.

Dr GT was serving RRL-Jorhat as the Director from 1974-1981. Thereafter, he joined as Director, IICT- Hyderabad and then Director, CLRI-Madras. Dr Thyagarajan was an efficient and popular Director and loved by all staff members of RRL-Jorhat. He reciprocated his love to RRL family evenly and visited RRL- Jorhat whenever there had been an occasion. He used to tell us in lighter mood that "You can throw me out from Assam, but you cannot throw Assam from my heart". This was his incredible affection showered to people of Assam. As a dignified Director that he could still occupy a respectable position in the heart of all family members of RRL-Jorhat.

Dr GT became Chairman of Research Council during the first decade of this century for two consecutive terms (2003-2009). During his tenure as Chairman, RC and Directorship of Dr P G Rao, the name of RRL- Jorhat was changed to North East Institute of Science & Technology (NEIST) during 2007 to show a broader aim and objective of the institute. The renaming of RRL-Jorhat to CSIR-NEIST was coined democratically under his guidance after taking inputs and suggestion from staff members. Also, his tenure as Chairman of RC for six years influenced the scientists of multi-disciplinary fields to work for the institute as a team. The multidisciplinary approach of work finally resulted in receiving prestigious CSIR Technology Award to CSIR-NEIST continuously for four years i.e. 2009, 2010, 2011 and 2012.

Dr GT's personality and encouragement had a direct impact in building my scientific carrier from a JRF to Sc-H/Outstanding scientist in 2010. Throughout my scientific carrier and till my retirement in 2015, I used to get inspiration from him to give my best effort to contribute to CSIR-NEIST.

Today, at this moment I pay my tribute to this visionary and extraordinary personality who contributed so much to CSIR as Directors of three premier Institutes - CSIR-NEIST, CSIR-IICT and CSIR-CLRI.

May God bless his soul to rest in peace. Om Shanti.

Lateral Transition from one Regional Research Laboratory to Another: Jorhat to Hyderabad

Dr. D. Srinivasa Reddy
Dr. Kaiser Jamil
Dr. M. Lakshmi Kantam
Shri R N Parlikar[$]
Dr. M F Rahman[$]
Dr. Malladi Pradhasaradhi
Shri T S R Anjaneyulu[$]

[$]Extracted from edited volume brought out in 1994





CSIR-IICT: Reminiscences of Dr. G. Thyagarajan

Dr. D. Srinivasa Reddy, Director, CSIR-IICT

CSIR-IICT is proud to be associated with Dr. G. Thyagarajan, a great organic chemist, technologist and a humanist. After his initial education in Tamil Nadu, he moved to Hyderabad and completed B.Sc. and M.Sc. Degree in Chemistry from Osmania University in 1956. Subsequently he joined RRL-H as Graduate Apprentice and parallelly completed the PhD degree in 1962 under the guidance of Dr. S. Hussain Zaheer and Dr. G. S. Siddhu.

During the period from 1957-1974, he was at RRL-Hyderabad at various capacities as Scientific Assistant, Scientist, Project Leader, Head of Division contributing to different projects of national and international importance. In the year 1974 he moved to RRL-Jorhat as a Director and held the position until 1981. Subsequently, he came back to RRL-H as Director and continued till 1985, before assuming charge as the Director of CLRI where he continued until 1994.

During the tenure at RRL-H, he had set clear goals for the laboratory programs. He was excellent in recognizing the talent and entrusting them by giving all out support. He was the force behind the formulation of a policy for the development of agrochemicals in CSIR laboratories and which later led in developing indigenous technologies and to name a few: Diazepam, Chiorodiazepoxide, Phospamidon, Quinoiphos, Butachior, Monocrotophos, Carbendazim and Chlorofenvinphos. Dr Thyagarajan had taken considerable interest in other areas too, for example coal research programme. His initiative on the low temperature carbonization of coal for the production of smokeless domestic fuel, came into limelight during his period. Later the know-how was successfully transferred to the Singareni Collieries Co. Ltd.

He is an unparalleled institutional-builder. Thyagarajan, not only worked for RRL-H, he leaves behind a number of institutions (RRL-Jorhat, CLRI) that will continue to do a great service to the nation in the domains of science and technology, skill-development and much more. CSIR-IICT deeply saddened with the loss of Dr. Thyagarajan and his special association with this institute, he is also alumni of our institute, will always be remembered. Our sincere prayers are with his family members to give strength and bear the loss.

Remembering a Visionary friend and Respectable

Former Director of RRL-H (IICT), Dr. G. Thyagarajan: revisiting some fond memories

Dr. Kaiser Jamil, Former Sci-G, CSIR-IICT

March 24th 2024 was a very sad day when the news reached me about the sad demise of our former respected friend and director Dr. G. Thyagarajan. The most difficult thing is in writing a tribute to the esteemed former Director, Dr. G. Thyagarajan, a great personality in the realm of Research and Development, whose legacy echoes through the corridors of the RRLabs (Regional Research Laboratories) with profound respect and admiration. In the year 1981 he came back to RRL as Director of our lab but earlier to that he was a Scientist and head of the Pesticide and Agrochemicals division of RRLabs, I am most privileged to share my experience working with him even before he became the director. He was not merely a director; he was a beacon of brilliance, guiding the scientific community with unwavering dedication and visionary leadership. His illustrious career in RRL was for a brief period of four years, as a Director, but the mark he made by his groundbreaking contributions had reshaped the landscape of research and innovation. Under his stewardship, the RRLs flourished into centers of excellence, nurturing talent and fostering a culture of inquiry and discovery. Dr. Thyagarajan's commitment to pushing the boundaries of knowledge knew no bounds, as he spearheaded numerous pioneering projects that left an indelible mark on science and technology.

Memories are like story books: they record our experiences and the lessons we have learnt from them. When we have quiet moments, we stumble upon them and catch up with them like a motion picture. They come and go, not quite in a sequence, but haphazardly upon introspection. Memories of my time at IICT is like a story book, I enjoy revisiting. I really don't know where to begin-my first memory goes back to the days when me and my husband Dr. Zafar Jamil shifted to D- Quarters in RRLabs colony, and we found ourselves in the neighborhood of Dr. Thyagarajan and his entire family, not only we met his wife Shyamala and his kids Latha, Ravi and Prem, but also met his mother and sisters and brothers, very loveable and friendly family. We always exchanged pleasantries with the family. At that time, he was head of Organic chemistry and Pesticides Division, and I was still working in the Entomology Division of RRL. While all of us in the colony came home by 6.00 or 6.30 pm – Dr. Thyagarajan continued to work in the lab and came home late in the night he was a dedicated and committed scientist. One fine morning we came to know about his promotion as Director of RRL –Jorhat and so shortly every one of his family moved out of the colony. After my PhD degree- working under Dr. M.B. Naidu- my supervisor and head of Entomology Division of RRL I joined Dr. P. M. Bhargava's

Biochemistry group on an advertised post, which subsequently became a full-fledged- Centre for Cellular and Molecular Biology lab (CCMB Lab).

While enjoying my thrill on being a CCMB scientist, I saw an Advertisement for a post of Senior scientist at RRLabs (IICT). I attended the interview at RRL, and, to my surprise and delight, I was selected. Despite my mentor and CCMB director- Dr. P.M. Bhargava's reluctance to see me go, I took up the challenging job at RRL under the directorship of Dr. GT Thyagarajan, as he had returned to RRLabs as a Director in 1981. My job requirements were to strengthen and contribute biological insights to some international projects from CSC (Commonwealth Science Council-UK) and TNO–Netherlands on Biological control of Insect pests and weeds. Dr. G. Thyagarajan, was the coordinator for those sponsored projects from overseas donors, and he was immensely happy with my contributions. I was sent for a training on Biocontrol strategies to Trinidad organized by Commonwealth Science Council (UK) where I learnt the technologies from international experts. and I was given the opportunity to become a resource person at two African Countries like Zimbabwe and Kenya. We published several papers and prepared reports together. It was my privilege to work with the highly reputed person like Dr. Thyagarajan, those were the most memorable days of my research career.

His intellect was matched only by his humility, inspiring all those around him to strive for greatness and pursue their passions with fervor. Dr. Thyagarajan's profound insights and astute guidance were instrumental in shaping the careers of countless researchers, who fondly remember him as a mentor, a friend, and a source of inspiration. Working with him on these international projects, we conducted two international conferences. With meticulous attention to details and a profound understanding of the importance of fostering global collaboration, Dr. Thyagarajan orchestrated conferences that were not just gatherings of minds but celebrations of diversity and shared humanity. One of his signature touches was the inclusion of cultural programs, seamlessly woven into the fabric of each conference to showcase the rich tapestry of Indian traditions. Whether it was music, dance, or theatrical performances, Dr. Thyagarajan recognized the power of culture to forge connections and deepen understanding among participants. Delegates not only engaged in intellectually stimulating discussions but also forged meaningful connections through shared cultural experiences, transcending linguistic and geographical barriers in the process.

Whatever I am saying is too little for such a dynamic leader- Dr. Thyagarajan who left a lasting impression. His accomplishments in other areas are also worth mentioning –In 1985, he was appointed as the Technical Advisor to India during the Bhopal Tragedy case at the UN Court, working closely with an American Law Firm. Later, he focused on Industrial Safety in hazardous areas, he was also a consulted for the Parliamentary Committee on pesticide residues in soft drinks. Then, subsequently, he chaired a Supreme Court Monitored Committee on Hazardous Waste Management. The list of his achievements is long and I remember only a few. He was the Chairman of Hussain Zaheer Science Foundation, and as the chairman he held several seminars and meetings, where as a Science Diplomat he expressed the challenges faced by the small countries in the areas of S&T I could attend one or two meetings.

He being interested in the science of Pesticides, I could understand his concerns about the hazards of the use of pesticides to the environment and to our lives, being a Toxicologist I was able to make suggestions in the areas of Pesticide toxicology, as we were publishing research papers on the acute and sub-acute toxicities of various pesticides. Thus, we could gel on these topics and finally he brought the alternate technology of Biological Control of pests and weeds. With this new idea he proposed a new branch of Biology and Biotechnology division, and I was heading this division until my superannuation in 2001, expanding its realm from a group of 8-10 people to a full-fledged group of 35 members. With his support we developed the lab with World –Bank funds and added new equipment like Electron Microscope, world class infrastructure for our Regulatory toxicology lab, and established contract Research for the Industry.

Beyond his professional achievements, Dr. Thyagarajan was known for his kindness, integrity, and unwavering commitment to excellence. He embodied the true spirit of a leader, leading by example and instilling confidence in those he led. As we reflect on the remarkable life and legacy of Dr. G. Thyagarajan, let us remember not only his extraordinary accomplishments but also the profound impact he had on all who had the privilege of knowing him. His contributions to science and humanity will continue to inspire generations to come, ensuring that his memory lives on as a testament to the power of intellect, integrity, and unwavering dedication.

Walking down the memory lane can bring up many things we have forgotten and put us in touch with the past. But by reliving those memories and moving past them, we can walk into the future with new hope and new confidence.

Encouraged by Dr. Thyagarajan, I also recall my joining the Organization of Women in Science for the Developing World (OWSD) with its headquarters in Trieste- Italy as a member and later I was elected as its President (2005- 2010), the aim and objectives of OWSD are to encourage women's education, develop scientific temper and encourage women to fight for gender equality and to break the glass ceiling and to join the decision-making stature. I am happy to say that my Organization- IICT encouraged me and fully supported my activities for motivating women Scientists to break gender barriers. I continue in my efforts to promote women to take up scientific careers and also meet international community of women scientists at various conferences and workshops

All I can say is that a scientist can never retire and I am still going forward with the motivation provided by Dr. Thyagarajan my director, friend and philosopher who will continue live in my memory always.

I am thankful to Director-IICT (Dr. Srinivasa Reddy) for asking me to share the memories of my time spent with a past Legendary Director of RRLabs like Dr. Thyagarajan.

Reminiscence - Dr. G. Thyagarajan

M. Lakshmi Kantam, Former Director, CSIR-IICT and Dr.B.P. Godrej Distinguished Professor of Green Chemistry and Sustainability Engineering, Department of Chemical Engineering, Institute of Chemical Technology, Matunga, Mumbai-400019, India

On 24th March 2024, CSIR, CSIR-NEIST, CSIR-IICT & CSIR-CLRI and overall Indian Science has lost one of its visionary leaders and Institution builders, Dr. G. Thyagarajan. At this moment, I am wordless to pen down my tribute to Dr. Thyagarajan, who was the guiding force in my entry to CSIR-IICT the then RRL(H). Way back in 1984, after my doctoral research and working one year in a college as a lecturer, I went to RRL(H) and met Dr. Thyagarajan, Director. He encouraged me to join RRL (H). I had been selected as a pool officer by CSIR; however, at the same time, he was instrumental in my appointment as Scientist B at RRL(H). Since then, I had several interactions and discussions with Dr. Thyagarajan during my entire professional career at RRL(H)/CSIR-IICT. He was a renowned organic chemist with a strong appreciation for translational research. He carried his commitment to translational research to all the three CSIR labs CSIR-NEIST/CSIR-IICT/CSIR-CLRI where he served as scientist/ director. Today, all the aforesaid labs have state of the art pilot plants & facilities, which is a prerequisite for translational research in their respective area of research. Taking inspiration from the commitment to translational research as a scientist at CSIR-IICT, I have practiced the art in a true spirit. I am happy that I have been able to translate several of my research findings into technologies for Indian industry.

Dr Thyagarajan worked quite extensively in the area of synthesis of heterocycles and organophosphorus compounds, a basic building block of insecticides/pesticides. Being an organic chemist, he was always fascinated with chemical/mechanical engineering and his research team and close associates always consisted of chemists & engineers. This was one of the best examples of team building, leadership and collaborative research, which I witnessed during my formative years as researcher. His vision and collaboration had resulted in the technology transfer of several insecticides/pesticides processes to industry, a truly remarkable achievement of CSIR for the contributions in the green revolution of India and/or in today's world for the self-reliant India in the area of pesticides/insecticides. Besides that, he was an avid reader with a perfect analytic brain by which he had shifted his research towards pharma/drug intermediates and industrial organic chemicals. RRL-H, now named as CSIR-IICT is one of the unique CSIR laboratories which backed up technical know-how with basic and detailed engineering packages. It provided end to end services to several chemical/allied industries. In this unique feature, Dr. Thyagarajan played a leadership role. Even after moving to CSIR-CLRI as the Director, he continued his deep-rooted association with CSIR-IICT. I have witnessed several of his lectures at CSIR-IICT & several seminars and symposia and also interacted with him on several occasions when he used to visit us during research council meetings. The vast experience acquired by leading three labs of CSIR, translational and interdisciplinary research was beneficial to our government in formulating and implementing various policies for the growth of Indian Science & Technology as member/chairman of several committees of

different ministries of Govt. of India. But he was a science leader whom the world was eyeing on, and he was chosen to serve as the Science Advisor to the Commonwealth Secretary General and Secretary of the Commonwealth Secretariat in London, where he served with distinction. When I became the director of CSIR-IICT, he advised me with his motivational words to build a team, focus/refocus on translational research with the right market-driven problem and also how to build trustworthy relationships with industry. He always considered CSIR-IICT as his home turf and used to own it. I do remember during one of his visits to CSIR-IICT, besides the science, he explained us the importance of hospitality with a personal touch, guest reception & transport for becoming a good institute for fostering collaboration. During my tenure as Director, whenever I requested him to come to CSIR-IICT, he came and motivated all of us. I used to enjoy the nice hospitality of Mrs. Thyagarajan and Dr. Thyagarajan at their home. The stature of CSIR-IICT today is because of strong foundation that was laid by its visionary leaders and stalwarts like Dr. G. Thyagarajan several decades ago. In this moment of emotion, I am sharing herewith a memorable photograph wherein Late Dr. G. Thyagarajan, Dr AV Rama Rao, Late Dr KV Raghavan, Dr JS Yadav are with me on occasion CSIR-IICT @ 70 Celebrations. His contributions in chemistry, wisdom of leading scientific institutions and directions for translational research will always guide and motivate us.

Memories recorded at the CSIR-IICT, Hyderabad during CSIR-IICT @ 70 Celebrations

Dr. Thyagarajan

(Extracted from Tribute published in 1994)

Shri R N Parlikar, Deputy Director, Indian Institute of Chemical technology,
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On Dr G Thyagarajan's retirement from the services of CSIR as Director, Central Leather Research Institute, Madras after a very distinguished professional career, I recall my experiences with him. I consider it as a privilege to have been asked to express my thoughts on very important and interesting interactions with Dr G Thyagarajan.

Even though I had met Dr Thyagarajan when he was Assistant Director in Organic Chemistry Division of erstwhile RRL, Hyderabad, I had no real contacts with him, We, both were pursuing totally different disciplines and interests. He is an organic chemist and I am a mechanical engineer. However, his dynamism in dealing with problems associated with the Institute or with the individual scientists could not escape anybody's attention. Even in those days it was mentioned that he would be a potential candidate to Head the erstwhile RRL and it became the reality subsequently.

My real contacts started with him when he took over the reins of the Directorship of RRL and these contacts developed into intimacy till he took over as Secretary, Commonwealth Science Council, London. For the first time a real dialogue between me and Dr Thyagarajan took place during the assignment of providing project engineering services of transfer of technology to M/s Sudarshan Chemical Industries Ltd., Pune. I found in Dr Thyagarajan an individual who could really appreciate and support and strengthen the design and engineering base which would help greatly in successful transfer of technology developed in the laboratories to an industry. In the present context of application-oriented work in the CSIR Laboratories, IICT's position to shape itself to the new thinking became far easier and to adopt itself to the new situation, and to meet the new demands was not difficult because of the foundation laid by Dr G Thyagarajan and his predecessor.

I particularly recall my association with him when he took over as Director of CLRI, Madras while also holding a dual charge as Director of Regional Research Laboratory, Hyderabad. During the initial period I submitted a note to him expressing that a tremendous scope existed for the CLRI to make a dent in application-oriented research required by leather industry by way of equipment development required for modernization of leather processing, computer aided design for leather goods and shoe industry and in bringing in more instrumentation and control and also in the use of non-conventional energy at an appropriate place. To this note, I did not get any response from him for quite some time. At the end of one month Dr Thyagarajan asked me to come to CLRI and have discussions with the scientists in that Institute on my note. It was a pleasant surprise to me. This only indicates Dr Thyagarajan's capability to appreciate and assess the potential of the proposals made. I am sure my note must have been discussed by him with the experts at CLRI and only after gathering their views, he invited me to Madras. The next initiative from Dr Thyagarajan was to take me along with him to visit the international leather

fair at Paris to visit the leather chemical manufacturers in Switzerland and Italy to hold discussions with the leather shoe manufacturers in Italy for supplying a pilot plant at CLRI for training Indian Scientists, Engineers, Technicians and extending this facility to meet the requirements of South East Asia. He gave me a free hand in the selection of these requirements and I am proud to note that the Computer Aided Design facility for leather goods, the pilot plant for shoes the instrumentation for leather processing unit operations from Switzerland, use of solar energy in drying of leather are today existing at CLRI, Madras.

Besides this I have found in him an excellent human being, who had always patience to listen to the problems of his staff and often he had always found a way out to extend full help. I had the privilege of working with him and enjoyed his company.

A Science Manager - Par Excellence

(Extracted from Tribute published in 1994)

Dr M F Rahman, Scientist, Indian Institute of Chemical Technology, Hyderabad

Right man in right place fits very well in describing Dr. G. Thyagarajan – some of the prestigious assignments have come to him at right time too. Joining RRL, Hyderabad from the neighboring Osmania University he had the opportunity of growing among some excellent research managers and men of scientific temper and human qualities, Dr. Rajan took ample interest in organic chemistry research to sustain himself in this competitive subject. His contribution to Diazepam process leased to Ranbaxy laboratories (marketed as calmpose) should rate as one of the major technological achievements of CSIR. The drug is in active production since 1974.

In 1971 on his return from NIH, USA he impressed upon Dr. Sidhu to initiate R&D work on pesticide processes and both visualized great future for this area. This is to his credit that the process development of pesticide technology has become the prime area of research in chemical sciences of CSIR with Hyderabad laboratory as the center of activity. Soon there were enough indications that a new and young leader in science management is in the making. It was Prof. Nayudamma who recognized his leadership talents and selected him in 1974 as Director of RRL, Jorhat. Soon the laboratory was transformed into an active and scientifically productive institute through the introduction of new and relevant areas of research useful not only to state of Assam but to the whole north-eastern region. He had promoted the scientific idea by taking it to rural areas by actively assisting in setting up small scale industries. There had been no dearth of affection and goodwill showered on him by the people and he became a very popular Director.

Beginning of 1981 was a home coming for Dr. Thyagarajan as Director, RRL, Hyderabad. He gave extra emphasis to the existing areas of research and took constant interest in the projects. He always advocated the idea of manpower development and groomed the second line to take higher responsibilities. He held high positions with dignity, integrity and exhibited broader outlook in executing his responsibilities. He made his staff to feel that he was the Director of all the people in the laboratory and not for a group of people. He believed in sharing the opportunity with others and always gave higher credits to his associates. In 1984, when he was asked to take over the Directorship of CLRI, he wondered what an organic chemist could do in leather research. To us he was so modest that he asked me in lighter sense to pass on any book on leather chemistry. In less than a decade, Dr. Thyagarajan by his innovative and novel ideas has put CLRI on the world map in leather technology. This is the tribute he pays to his mentors Dr. Husain Zaheer, Dr. Sidhu and Dr. Nayudamma who had so much faith in his leadership qualities.

I feel our country has produced several scientists, however there has always been a dearth of good science managers. As a close associate I admire his tremendous leadership qualities which has benefited 3 national laboratories and a large scientific community in general. Dr. Thyagarajan has still so much to offer in shaping the scientific future of our country. I wish that there are opportunities to make use of his untapped energy and knowledge

Dr G Thyagarajan

Malladi Pradhasaradhi, Retired Scientist 'G', CSIR-IICT

Dr G. Thyagarajan after graduation from Osmania University started his scientific career at RR Labs in the synthesis of 7-membered and 6-membered nitrogen heterocyclic compounds. After the national TNS symposium held in the late 1960's Dr. Thyagarajan started process development work on Diazapan, Dazapomide. In the 1970's he led a big group in organic chemistry with the collaboration of the chemical engineering division in the process development of Agrochemicals, namely Benomyl, and Monocrotophos and also in the preparation of phosgene for the preparation of carbamate insecticides. He has been to the University of California and has proven his managerial qualities ever since as director of RRL's.

He was appointed as Director of RRL (Jorhat) Assam where he directed his scientific attention towards pesticide development and also petroleum transportation through tubes taking advantage of the colligative properties of fluids. He took an interest in Rheology and mooted several projects at RRL Jorhat. Later he came back as Director of RRL Laboratories Hyderabad.

From Hyderabad, he was made director of CLRI Madras where he turned his attention into the preparation of polymer chemistry, and footwear design by computer simulation. He has also done a good amount of work in pollution control in the Leather Industry in the area of recovery of chromium and chromium compounds. With the above scientific achievements, Dr Thyagarajan stood up as a unique science manager.

Success Story of Coal R&D Projects in IICT

(Extracted from Tribute published in 1994)

T S R Anjaneyulu, Deputy Director, Indian Institute of Chemical Technology, Hyderabad

Indian Institute of Chemical Technology, Hyderabad (formerly known as Regional Research Laboratory) has been devoting considerable attention to R&D work on coal for the past four decades with a view to rationally utilize the country's vast reserves of low-grade coal for energy and other purposes. In this note, the contribution of Dr G Thyagarajan who was the Director during 1981-85 to the R&D activities of the coal group is brought out.

The first project on rational utilization of coal successfully completed by the Institute was on low temperature carbonization of coal (LTC) for the production of smokeless domestic fuel. The know-how was successfully transferred to the Singareni Collieries Co. Ltd. The plant commissioned in December 1979 was undergoing teething problems when Dr Thyagarajan took up the Directorship in February 1981. Under his leadership, the Laboratory provided all technical support beyond the contractual obligations for solving the problems and making the LTC project a technological success. This plant is totally indigenous. On behalf of IICT, he received the FICCI award in 1981 for technological research on LTC.

Another major area of coal R&D in IICT has been complete gasification of coal. Work on this was again initiated by late Dr S Husain Zaheer and a 1 ton/hr pilot plant based on moving bed gasification was procured from Germany and France during 1964-66. This plant could not be fully erected and commissioned due to administrative problems, difference of opinion with headquarters and non-availability of funds. With the first oil crisis in 1973, emphasis was given to this project and the required sanctions were given and necessary funds made available to the institute. The required indigenous equipment was procured and the erection was completed by the laboratory on its own. At this stage, Dr Thyagarajan took over as director and after analyzing the various technical and administrative problems, gave priority to its commissioning. He discussed with CFRI and got technical assistance for the erection of the critical equipment as they had a similar pilot plant. According to the original agreement with the foreign equipment supplier, assistance for erection and commissioning of the plant was to be provided by them. But they raised the question of secrecy and insisted on the institute to sign a fresh agreement. Dr Thyagarajan visited Germany and successfully negotiated with the foreign supplier and obtained the services of 2 German experts for the final check-up and commissioning of the plant This was under the $1.02 million UNDP assistance for the coal gasification project. Dr Thyagarajan provided all administrative support for the UNDP programme for getting equipment and foreign experts for the project. He also gave necessary sanctions for creation of additional staff and redeployment of staff for operation of the pilot plant. The pilot plant was successfully commissioned in December 1983. He also got further financial support for getting coal from other agencies for the test in the pilot plant. The work in the project was appreciated by Dr K H van Heek of FRG, Chief Technical Adviser for the UNDP project and by Dr

M R Ghate of USA who did the final evaluation of the project for UNIDO/UNDP. Dr Thyagarajan's contribution to this project remains significant.

When he was director, he initiated some basic work on solubilization of coal. Thus, during the tenure of directorship of IICT, Hyderabad, Dr Thyagarajan had taken considerable interest in coal research programme and provided all encouragement and support.

Emerging as A Go-To man of CSIR

Dr. S.K. Joshi[$]
Dr. T. Ramasami
R N Bhargava[$]
Dr M P Dhir[$]
Dr N R Rajagopal[$]

[$]Extracted from edited volume brought out in 1994

Dr. G. Thyagarajan – a Tribute

(Extracted from Tribute published in 1994)

Dr. S.K. Joshi, Director General, Council of Scientific and Industrial Research

I had the pleasure of meeting Dr. G. Thyagarajan for the first time before I assumed charge as the Director of the National Physical Laboratory, New Delhi, in 1986. It was in the Directors' meet at the India International Centre, New Delhi. A few minutes of talking with him and also listening to him was enough to convince me of his deep commitment to the cause of CSIR. I had heard of his dynamism and zeal in promoting strong linkages between research and industry and I had, during my interaction with him in CSIR, several occasions to personally witness these qualities at close quarters. His commitment to CSIR and its growth was extraordinary.

His three-year tenure as the Secretary of the Commonwealth Science Council was of relevance to the furtherance of CSIR interests, justifiably though, in the Commonwealth area. A direct benefit that resulted in. forging linkages with the other countries, particularly in the Afro-Asian theatre, was the formation in NPL of the Centre for Metrology under the auspices of the Commonwealth Science Council. The NPL Centre came up largely because of his ability to project forcefully the immense strength the Laboratory possessed in the fields of Standards, Metrology and Industrial Physics. He saw to it that the Idea of a Commonwealth Centre with in NPL was translated into action and personally supervised the initial operations.

The entry of CSIR in international collaborative oceanographic research is due to Dr. Thyagarajan. He advocated in favor of NIO making a splash in the Caribbean waters by making known that the Institute with its strong infrastructure in terms of a sophisticated Research Vessel and highly skilled multi-disciplinary team of experts could impart on-board training to the scientists of the Caribbean countries. This was unprecedented because only a handful of advanced countries were credited with this specialization. And we were party to the implementation of an excellent collaborative research programme on oceanographic research sponsored by the Government of India (no less than tt1e then Prime Minister, Shri Rajiv Gandhi gave his blessings to the Programme), the Commonwealth Science Council and the Governments of Caribbean Islands.

CORE - Caribbean Ocean Research Expedition - as it was called, was an outstanding example of successful international collaboration in science involving India and some of the Islands there. Much of the credit for the operation of the programme should go to Dr. Thyagarajan, who worked assiduously on it from conception to completion.

When the Golden Jubilee celebrations of CSIR were being planned in 1992, the choice of the Chairmanship of the Central Organizing Committee fell naturally on Dr. Thyagarajan. In a series of seminars, meets, events, meticulously planned, he projected the image of the organization in ever so many ways. There was about this year-long programme a certain

dignity attached and Dr. Thyagarajan personally oversaw all the functions, including the finale in September, 1992 when Rasthtrapatiji commended the services rendered by CSIR these fifty years.

Several novel features, including the presentation of a one-time memento to all CSIR employees, were introduced by him. The International Conference of Heads of Scientific Agencies (ICOHOSA) organized towards the close of the Golden Jubilee was yet another bright idea of Dr. Thyagarajan. It was very thoughtful of him to have juxtaposed this meet during that year because it was exactly then that public-funded R&D institutions all over the world were straining under resource-crunch. The occasion provided an excellent opportunity for Heads of Scientific Agencies (most of them having bilateral agreements with CSIR) to exchange notes on the different kinds of strategies they proposed to adopt to steer clear of the financial straits they had been led into.

There are several such significant contributions that Dr. Thyagarajan has made to CSIR at the national and international planes. I have only chosen a few of recent period - the ones with which I have had the pleasure of collaborating with him. The transformation of CLRI into an R&D Institute of national importance from the academic as well as the industry-points of view is now a reality. It is Dr. Thyagarajan who is responsible for this desirable change. The mission on leather, approved by the Government of India, has been conceived by him. It is due to his efforts that CLRI is now looked upon as the technical arm of leather industry and as an Institution on which the Government places its trust for policy-making in leather industry.

What impressed me was his innovative approach, his optimism, his capability in uniting diverse groups in a major programme, and his breadth of understanding of the technology scenario in our country. His understanding of the CSIR system has been profound. When CSIR was facing the erstwhile Parliamentary Committee on Science & Technology, I could see that he could blunt the thorns of any prickly topic. Thus, from whichever angle one views it, here is a Director of a CSIR Laboratory who has during his long tenure in CSIR distinguished himself as an innovator and it is worth following some of the traditions he leaves behind. It is difficult to do justice to Thyagarajan's contributions in such a short note.

It will now be our duty to carry forward the programs, the dreams and the vision he carved out for CLRI. We have to put our best to create a special place for CLRI in the whole world in the sphere of leather research & development. His dreams of CLRI becoming the "The global Centre of Excellence" has been passed on to his colleagues. The best way to pay tribute to Dr. Thyagarajan will be the pursuit of excellence in any sphere one is working.

Impactful contributions of Dr G Thyagarajan to CSIR on different occasions

T Ramasami, Former Director of Central Leather Research Institute and Former Director General of CSIR (Additional Charge)

Dr G Thyagarajan may have served the Council of Scientific and Industrial Research for record purposes as its Director General for only a short time, but he was always the man on whom CSIR relied on occasions of challenges. He was truly the Go-To man for CSIR. Some illustrative cases of such occasions have been listed here for conveying the spirit of service of Dr GT to CSIR at all moments calling for an efficient management of change and crisis.

Dr Y Nayudamma as the Director General of CSIR had embarked upon a unique Shoe How experiment on the part of CSIR. He ventured to adopt Karim Nagar District and showcase the power of CSIR developed technologies in redressing the social needs of rural communities. He chose to select Dr G Thyagarajan, then a senior scientist of the then RRL-H to lead the CSIR body of professionals. It was a bold experiment on the part of CSIR. Dr GT was the Go-To man for coordinating one of the most difficult tasks undertaken by the agency for relating scientific research outputs through show how experiments for redressal of real-life problems in rural India.

In his professional career as Director of RRL Jorhat, he used to be invited as a resource person to almost all the internal management training programs. My friend Dr R K Bhandari, who was later Director of Central Building Research Institute in Roorkee, shared his experience with Dr GT in the year 1975. It seems that Dr Bhandari attended he 4th Management Training program held at CSIO, Chandigarh in July 1975 that Dr GT made a lasting impact on all his colleagues. It seems that GT left the message that CSIR must address real life problems and felt needs of the society. GT was barely 41 then. CSIR had chosen to enroll him as the motivating resource person for the entire agency in shaping future leaders and aligning them to mandated goals of the agency.

Role played by Dr Thyagarajan in handling the aftermath of Bhopal disaster by CSIR was vital and critical. Following the industrial catastrophe, the then Director General of CSIR, Dr Varadharajan assembled quickly a professional team in which Dr G Thyagarajan formed a key member. I am privy to the numerous messages received by Dr GT at that time in rising up to the demands of an unprecedented crisis in the history of independent India. Dr GT played some important and unique roles on behalf of CSIR. In handling the aftermath of Bhopal disaster, Dr GT played a central hub of all activities of CSIR.

During the tenure of Dr S K Joshi as the Director General of CSIR, the agency was commemorating its Golden Jubilee. Dr Joshi decided to call upon the services of Dr G Thyagarajan for planning, coordinating and commanding the entire year long programs. GT made meticulous plan and oversaw the entire year-long celebration in the year 1992 with so much involvement that it evoked a sense of pride among several colleagues in

the agency. As someone who assisted him in the celebration process, I was witness to the enormous value brought by GT to the Golden Jubilee celebration of CSIR.

During the tenure of Dr R A Mashelkar as the Director General of CSIR, think tank of the agency had recommended the consolidation of strengths and merger of laboratories for improved organizational efficiency. Merger and closer of institutions in India raise several concerns and lead to social upheavals. Two CSIR laboratories located at Dhanbad, namely Central Fuel Research Laboratory and Central Mining Research Institute were engaged in similar research and complimenting research priorities. CSIR management found it appropriate to merge the two institutions. It was a moment of challenge. Social issues associated with the implementation of the decision had to be addressed and resolved prior to the merger. Services of Dr G Thyagarajan were called upon by Dr R A Mashelkar. Dr GT engaged various cross sections of stake holder and share-holders and made the transition not only smooth but even welcomed by all concerned. This led to the birth Central Institute of Mining and Fuel Research in 2007. As I was holding additional charge as DG then, I witnessed a smooth transition. It is a true hallmark of the high level of acceptability of the persona of Dr GT as the man of CSIR

He served as the Chairman of the CSIR Sports Promotion Board for considerable length of time. Sports promotion activities of the agency registered an exponential growth during his tenure. Even after his superannuation from CSIR, he used to deliver numerous lectures concerning the organizational reforms pertaining to CSIR. The CSIR Foundation Day lecture delivered at National Chemical Laboratory carried some vital messages of lasting value to CSIR. For those known to him, GT was a 100% CSIR man. To him, CSIR mattered as much as India. He saw India through the prism of CSIR. He reminds the ever-lasting spirit of CSIR as the National custodian of non-strategic industrial research. He has carved for himself a unique and permanent space.

Dr G Thyagarajan

(Extracted from Tribute published in 1994)

R N Bhargava, Adviser (Planning), CSIR (Retd.)

I feel honored to write a few paragraphs on Dr G Thyagarajan so as to bring out the highlights of our association with him for over two decades. It is a pleasure to recollect several pleasant points and qualities of Dr Thyagarajan's multi-dimensional personality, but I am mentioning only a few of them below.

He is a rare charismatic leader who can infuse confidence in all his colleagues and foster team spirit. Some of us recollect the challenge posed to CSIR on the development of indigenous technology for various pesticides to arrest the big drain on our foreign exchange resources in the seventies. A team was carved out from three laboratories under his leadership and this was a big challenge at that time, especially when coordinated multi-lab programme was very difficult to achieve. He fulfilled the mission with acclaim. Several technologies flowed from this interactive group and the CSIR reaped a rich harvest in the game. Several such instances e.g. flow improver, etc. can be quoted where he proved to be a wonderful leader. As the Director of three laboratories at different times, he provided excellent leadership and modernized the facilities everywhere so that the scientists could bring out their best.

He is a scientist with a vision and has a third eye to perceive the future and select such technologies which would be needed in a futuristic framework of time. This has been amply proved in the selection of R&D programme at Jorhat, Hyderabad and at CLRI, Madras.

He has been an efficient commander in the CSIR system to take up any assignment at the behest of the higher echelons in the interest of the organization. Many would not be aware of the fact that during formulating of the sixth plan, the then Director-General, Dr G S Sidhu, had nominated Dr Thyagarajan to be the team leader to prepare a draft five-year plan of CSIR collating all the strengths of the organization so as to cash on visible opportunities during the sixth plan period. With his broad vision, he evolved appropriate guidelines to make a comprehensive plan document which was appreciated by one and all including the Planning Commission, giving everyone a feeling that Dr Thyagarajan is not only an excellent scientist in his own field but has a fine overview of the CSIR.

He is a person with adorable qualities and has been able to interact at all levels with us at the headquarters, extracting maximum benefits for his laboratory. I had also the rare privilege of meeting and interacting with him while he was occupying a key position at the Commonwealth Science Council (CSC), a multinational forum in London. His colleagues had extolled his informal working style, progressive approach, personal relationships and such other dynamic qualities which resulted in unprecedented output in that forum.

Dr G Thyagarajan

(Extracted from Tribute published in 1994)

Dr M P Dhir, Director (EC), CSIR, New Delhi.

Dr G Thyagarajan and I grew up together in CSIR, joining in the 50s and superannuating in 90s. The interactions have covered the eras when he was a Scientist at RRL-H, Director at RRL-J, Director at IICT-H, Director at CLRI, Madras and as Secretary to the Commonwealth Science Council in London. The work on a few committees also brought us together.

Dr Thyagarajan has spent almost his entire professional life in the CSIR system. His knowledge and commitment concerning CSIR have been deep and abiding. It would be in the fitness of things to call him both a product and a pillar of CSIR.

I count Dr Thyagarajan among those who make impact wherever they work. The three laboratories which had the benefit of his stewardship provide ample evidence of the reorientation they received. He is a visionary who requires a rather broad canvas for his operations. On policy issues, he goes to great lengths consult, to visit and get things done, at the same time, giving enough elbow-room to his associates for freedom of action and for developing themselves.

Dr Thyagarajan has developed an insight into a large variety of areas of science-based development and science management. He is good at interacting with people of varying backgrounds. If one spends long years in one organization, it happens, many a time that one becomes a prisoner of the tradition and precedents. I have found an exception in Dr Thyagarajan in this regard. Mentally, he likes to move with the times and is more than willing to make adjustments as warranted from time to time. It matters less to him if the resulting changes appear to be radical to some.

An outstanding aspect of Dr Thyagarajan as a science manager is that his working day extends far into the evening for formal and informal interactions. With relaxed disposition, he is always receptive to blends of humor. It is only to be expected therefore that the environment around him would be conducive to bring out the best from his associates.

It is very difficult to take CSIR out of their bloodstream for those who spent three to four decades in the organization even after they have relinquished their official positions. Dr. Thyagarajan will continue to be a CSIR-man and support it from wherever he operates. I wish him success in his future endeavors.

As I Know Him

(Extracted from Tribute published in 1994)

Dr N R Rajagopal, Head. HRDG, CSIR, New Delhi

Gopalakrishna Thyagarajan, variously known as Thyagarajan, GT is indeed a many-splendored personality. My association with him dates back to the year 1962, when he was working in the Organic Chemistry Division of the Regional Research Laboratory (RRL) now known as the Indian Institute of Chemical Technology (IICT), Hyderabad. Behind our meeting is an interesting episode. A Conference of Directors had been called at RRL and along with others from the CSIR headquarters. New Delhi I had descended on RRL, donning the role of a back-room boy. While the seniors got adequate accommodation facilities in and around the campus, poor me was left in the cold to fend for myself. It was then Dr Thyagarajan (one of the members of the organizing committee) came to my rescue. He found me a place to stay, arranged for my boarding and in fact took me home on a couple of occasions to share a meal. We became good friends and I developed a respect for this young scientist, who was then not only spoken of as a man with a bright future but known to be generous to a fault, who else would feed an unimpressive and unknown fellow from Headquarters.

Thereafter, he left for the USA and I lost his contact. We renewed our friendship and professional relationship in 1974 when he joined the Regional Research Laboratory, Jorhat as its Director. His appointment as 'its' Director was a sort of records. He was the youngest to have become the Director of a laboratory (after Dr Nayudamma) and in being selected to the post he made quite a quantum jump. It is interesting to note that Nayudamma was the Director-General of CSIR then. Trust one young ex-Director to spot another!

Most of us at the CSIR HQ welcomed Dr Thyagarajan's appointment. We had different reasons but all were agreed that he was the right choice because (a) he was a CSIR scientist and young (b) he had already made a deep impression on the members of the various technical discussions (particularly the planning discussion of which I was a member) as one who could deliver the goods and (c) he was elegant in his style, sophisticated in thinking and accessible to all. These qualities were to prove his forte and later render him one of the outstanding R&D managers in the country and certainly in the CSIR system.

On his joining, RRL Jorhat, hitherto confirmed to the inner recesses of the North-East Region, underwent a metamorphosis. Projects were given the hard look they deserved some dropped, some given a new reorientation and some given the thrust needed to take them up to stages of objective-fulfilment. As a skillful weaver of silken threads GT (by then the name had stuck) intermeshed his men and resources to fabricate a structure that was at once visible and result-yielding. The laboratory, thinks to his contacts and projections, did not any more remain 'Regional'. It became a national laboratory - in fact the pride of Assam. GT could articulate so successfully that the usually tough and questioning planning division blocks at the Hqrs (I was one of them please) were mesmerized into allowing massive inputs for this laboratory. His transparent attitude towards the people of the

region, his innate love for all that is Indian - be it from Thiruchitrambalam in deep South or from Zapajihala in Nagaland and above all his trust in his colleagues brought about the much-desired transformation in a laboratory that was almost relegated to the background till he went there. The various governments in the Region unrolled the red carpet for him.

RRL made a big and convincing splash in the area of pesticides - the organo phosphorous and the organo chlorous varieties. Together with RRL, Hyderabad and NCL, the Jorhat Laboratory, headed by GT brought the country to the point of self-reliance in the area of pesticides. This one development is a major contribution to the country and the part played by GT in it is significant. He was one of the top five scientists of CSIR who met the Prime Minister (Smt Indira Gandhi) and assured her of CSIR's success. A lead time was agreed to and as promised GT and his colleagues delivered the technologies (I must, as a true historian of CSIR affairs, record here the dedicated help GT received from Dr KV Raghavan, in the successful completion at RRL-J, of this project).

The Jorhat laboratory was known for the other innovations of Dr Thyagarajan. He opened up discussions for modem biology, seismic surveillance, utilization of natural products of the region (water hyacinth to boot), oil well chemicals, medicinal and aromatic plants and rural technology. Operational Research and R&D management specialists found something to do under his guidance. He won the appreciation of the people of Nagaland by inviting their students and giving them exposure and training in a modem laboratory - something that was unprecedented but certainly welcomed. To top it all, as a shrewd Director, he improved campus facilities, provided better and modem living amenities to his staff and introduced social gathering and community life. One particular brainwave of his (several were to follow, of course) was to entice the CSIR Sports Promotion Board to agree to organize the Bhatnagar Memorial Tournament at RRL, Jorhat in the beginning of 1981. It was a roaring success and GT became popular in the entire CSIR family in different levels.

From Jorhat to Hyderabad was a lateral shift for him in more than one sense, it was home-coming. I asked him why he moved out from Jorhat. The answer was "I came to Jorhat with a specific purpose. I think 1 have achieved it, I shouldn't stay there after that. Normally 1 do not like to slick on to one place for more than five years". That sums up the philosophy. His stint at Hyderabad was also short. Even in this short period he proved a master batsman playing in his home ground. The laboratory started looking up. New facilities were created, sophisticated equipment acquired and projects trimmed and redefined to bring out clearly terminal objectives. About this time, he became the Chairman of the Coordination Council for Chemical Sciences. What a splendid job he did! (I should know because I was directly dealing with it in the Hqrs Planning), It was the only Coordination Council to have functioned with some degree of successful inter-lab coordination. I dare say it was because he was the Chairman and wanted results.

Another notable contribution of GT during this time was in the area of Planning, (By the way, the acronym GT at Hqrs was appropriated by someone else. And the three S's - Swami, Sri and Sekhar there settled for Hyderabad Iyer whenever we wanted to mention

GT in private conversation, when I mentioned it to him, he like the good sport he is, had a hearty laugh).

So, 'Hyderabad Iyer' was made the Chairman of the Steering Committee for the formulation of the Seventh Plan of CSIR (1985-90). The Planning Division at the Headquarters (S/ Shri Bhatnagar, Sen, Garg, Chandrasekar and yours truly) had its teeth into it. A lot of drafting and editing work was involved. For some inexplicable reasons, he chose me for the job. Between us we climbed over a mountain of papers - most of them plan programmes of different laboratories arranged according to major areas of thrust - and finally produced a draft as per norms of the steering committee. I could then marvel at the intelligence of the man, the ability to zero in on a few striking sentences what normally one would put down in lengthy paragraphs and a total commitment to see that the best image of CSIR was projected. It was indeed a pleasure, nay a lasting experience of learning to have worked with him on these drafts. The final product did receive the discriminating nod of a few pundits.

At Hyderabad, his penchant for leaving permanent assets behind manifested again. The guest house at IICT (perhaps the best in the CSIR system), the flood lit tennis court nearby, the open-air auditorium as an extension of the club house and the fine cricket ground in the colony (the last three, the spin-offs of Bhatnagar Tournaments) are witness to the dynamism of this Director in providing for his staff the best possible environment for creative work.

Well, it was time for him to move away from Hyderabad. And the opportunity presented itself with the position of the Director of CLRI falling vacant. So, it was in late 1984 that he was named the Director of the Central Leather Research Institute, Madras. Eyebrows were raised - an Organic Chemist to be the head of CLRI? Those were un-knowing eyebrows. The raised ones came down within a few months of his taking over.

As is his wont, GT quickly grasped the situation and established fine rapport with the representatives of the leather industry. His innate understanding of the intricacies of industrial research, the triple-strength one derives in bringing together the CSIR laboratory, the university and the industry and the opportunities for growth that this sector offered, showed up in full measure at CLRI. He walked over to the departments next door (and at IITs) and conquered hearts. He expanded the infrastructural capability of the laboratory. Computer Aided Design of footwear, FT/NMR equipment. Triple Helix auditorium -these are there for everyone to see.

And once again, a break for him. This time as the Secretary of the Commonwealth Science Council at London. India in general and CSIR in particular were the gainers. Some of us who had seen him function there admired at the ease with which he slid into a slot that had international dimensions about it and hence was sensitive. There too, he left his mark, and for CSIR the metrology centre at NPL and the Caribbean Ocean research expedition were two of the most successful examples of international collaboration, an area in which his

rich potential came to the fore during the three years he spent in London.

His return to CLRI in Jan 1991 was welcomed by a few of us at the headquarters. It appeared the Institute needed a massive dose of something that energized it. He was known to have administered such doses to units that needed them (Mark here, the adjective before 'units' is avoided). The return of the native proved beneficial to CLRI of course. In these three years, several important things have happened; the GAIT analysis laboratory, the spurt of activities in the area of risk and hazard analysis and the input in rural and backward areas in collaboration with the saint of Kundrakudi.

I will not speak much about GT's latest venture TAFILS (Technology Assessment and Forecasting in the Indian Leather Sector) excepting to point out that this is the first time in CSIR that a nation-wide (and possibly international) exercise in long-range planning in a major technology area of immediate relevance has been undertaken. The leather industry, all of us know, cannot easily forget Nayudamma. We should now add the name of Thyagarajan too.

It is said that all great people had humble beginnings. GT is no exception. He still recalls his younger days when he had to undergo the grind. The protest you see is the result of that arduous exercise. Behind the facade of the urbane, sophisticated and well-turned out R&D Director is a simple soul, full of human qualities with malice to none. His interest in welfare activities was best known when he took over the Presidentship of the CSIR Sports Promotion Board in 1986. The budget went up in one shot; the impoverished clubs received bonanza in the form of games kits and several projects were sanctioned to pump up the enthusiasm of the clubbers in the laboratories. I am a big spender said he and proved it by setting high targets in the game. Even though not officially connected with it, he continued to evince interest in the activities of the Board by offering novel suggestions. That again is another strength. Any worthwhile project connected with increasing the effectivity of the system will always receive his best scrutiny. And he has always one up his sleeve - some good suggestion that one cannot possibly ignore.

My impressions of his character for over thirty years may appear one sided but what else is one supposed to say about a gentleman who has the distinction of not losing his temper ever, not speaking ill of any one and always looks at the positive side of life? A man with a ready wit for any gathering, be it convivial or otherwise and a flair for saying the right thing on the right occasion, Thyagarajan is highly respected in the CSIR family.

A rose by any name is rose, says the bard. So, whether you call him Rajan, GT or Thyaga (or Hyderabad Iyer), Dr G Thyagarajan is a rare blend of fine elements.

Transition of A Go-To Man into A Man with Golden Touch for Leather Sector

Dr K.V. Raghavan[$]
Dr S Ramachandran[$]
Shri Sanjoy Sen[$]
Mr. A Sahasranaman[$]
Mr. P S Ananthanarayanan[$]
Dr I S Bhardwaj[$]
Mr. M M Hashim[$]

[$]Extracted from edited volume brought out in 1994





GT's Land Marks in Leather Research at CLRI

(Extracted from Tribute published in 1994)

Dr K.V. Raghavan, Deputy Director CLRI, Madras

The Central Leather Research Institute (CLRI) at Madras was conceived in 1945 and established in 1948. Objective behind CLRI is to achieve excellence in leather research in selected frontier areas, to develop and deliver process technologies for leather and allied industries and to train skilled manpower. The institute's development has seen three distinct phases of growth during its 40 years of illustrious existence.

The first phase covering initial two decades of its existence, was marked by the research/ technical advancement in collagen chemistry, tanning and finishing, leather auxiliary technologies, leather trades engineering, leather economics and extension services for technology propagation. The pioneering contributions of Dr B M Das as its first Director and, legendary Prof Nayudamma as its main architect had dominated the leather scene in the country. Prof Nayudamma succeeded in transforming the art of leather making into a science and finally to technology. He was instrumental in establishing a chain of extension centres in other parts of the country to technically assist the tanners to better the quality of their leathers and products. He also infused a sense of self-reliance among the scientists and technologists to develop technologies appropriate to the local needs.

The second phase covering the third decade of CLRl's existence witnessed unprecedented demand for various services of the institute. During this period, the CLRI launched several HRD programmes for enhancing the manufacturing skills of technical personnel and developed and transferred technologies for the manufacture of finished leathers and chemicals needed by the newly established process units. Basic scientific advances in collc1gen physics and chemistry, vegetable and mineral tannages, bacteriology of leather and animal byproducts were made.

GT has the distinction of leading the destiny of CLRI during the third and the most critical phase of its development. By this time, a perceptible change had come in the outlook of Indian leather industry particularly its urge for modern and internationally competitive technologies. Apprehensions were expressed for the first time at several public forums that technologically CLRI was not ahead of the industry. Added to this, there were compelling requirements for the industry to meet the quality demands and competition of the international markets and the challenges of growing national environmental regulations. GT quickly acted and took appropriate corrective measures to place CLRI back in the driver's seat by not only regaining its scientific and technological pre-eminence but also placing it on the international map. The saga of his success at CLRI provides several lessons to the managers of large national institutions.

Structural Reorganization for Functional Efficiency

The first task, GT undertook on assuming charge as the Director of CLRI in 1984-85 was to reorganize the research and support departments into four umbrella divisions viz., bio,

chemical, engineering and information sciences with appropriate functional areas (nearly 20) attached to them. Special status was given to Extension and Mass Communication, Education and Training and International Scientific Collaboration departments. These measures greatly contributed to the professional growth of the concerned scientific and technical staff, inter disciplinary collaboration and optimal utilization of financial and material resources.

GT took the major step in 1985 to strengthen the second line in the laboratory management. Managerial responsibilities were decentralized to involve the Heads of Divisions, senior scientists and project leaders in day to day management of the institute. This arrangement provided the much-needed stability and continuity as evidenced by its smooth functioning during GT's three years CSC assignment at London. Dr RB Mitra provided the necessary leadership during 1988-1990 and pursued the long-term policies of the institute with distinction.

Nationwide Resource Surveys

To assess the true potential of Indian resource base for the leather making and its utilization capacity by the industry, two major surveys on hides and skins availability and the capacity utilization of Indian tanneries respectively were completed during GT's tenure. These surveys enabled CLRI to assess the modernization, Human resource Development and policy needs of the leather sector in the country. The data generated by these surveys have been widely cited for their quality and authenticity.

Accent on Applied Research

GT's research policy at the CLRI was based on the concept of coexistence of good quality applied and basic research for the overall development of science and technology of leather and allied fields. Process development, modelling and simulation, biomechanics of footwear, water and chrome management in leather processing, biotechnologies for leather processing and effluent treatment, specialty fatliquors and syntans, new vegetable tannages are some of the applied areas which received thrust during his tenure. The CLRI scientists received outstanding chemical engineer, CDC, NRDC and other National awards for their significant contributions to applied research during his tenure.

Credit goes to GT for creating chemical engineering faculty at CLRI in 1986 and creation of excellent scale up facilities at bench and pilot levels for the development of technologies for chemical auxiliaries. This initiative has greatly strengthened CLRI's capabilities in delivering scaled up process knowhow and basic engineering packages and hazard and risk assessment reports to leather and allied industries. The concepts of process design, plant engineering, modelling and simulation and transport phenomenon have been applied to leather processing for the first time in the world.

The impact of GT's contribution to applied research efforts could be seen from the significant rise in the number of industry sponsored research and consultancy assignments and along with them the enhanced external cash flows.

Quest for Quality Research

GT provided a big boost to basic research in several frontier areas in leather and allied sciences at CLRI by encouraging younger talent to adopt research as their career and by strengthening the infrastructure facilities. Advanced research groups in magnetic resonance, chromium chemistry, bioinorganic chemistry, collagen chemistry and physics, chemical engineering and polymer sciences have made high impact in the academic fraternity in their areas. Imaging through NMR and ultrasonics, metal-protein interactions and active site chemistry of metallo enzymes, modelling of tanning processes are some of the new areas of research nurtured during his tenure.

Sophisticated instrumental facilities including FT-NMR (300 mHz), FT-IR, SEM, HPLC, microcalorimetric thermal analysis laboratory etc., were created with large scale financial support from national and international agencies. An average of nearly 50 scientific papers have been published from CLRI in highly cited national and international journals every year since 1985 in leather science, polymer chemistry, inorganic chemistry, biosciences, spectroscopy, engineering and computer sciences and other areas.

Dr T Ramasami has been awarded the prestigious Shanti Swarup Bhatnagar Award (1993) for his pioneering work in aqueous chemistry of chromium complexes, for the first time in the history of CLRI, and Dr N Chandrakumar received the CSIR Young Scientist Award for the development of novel NMR techniques. They bear testimony to the congenial work environment that exists at CLRI for research in basic sciences.

New Policy Initiatives

GT, as the Director of CLRI, had evolved several new concepts and policies for the leather industry. They include tannery relocation in well-engineered leather complexes, common effluent treatment for tannery clusters, modular concept for expansion and upgradation of leather processing facilities, multi-level training strategies for leather product sector, technology grid for grass root level growth of leather sector, national slaughter policy, hides/skins as coproducts of meat industry etc.

The leather industry and the Government received these new ideas with overwhelming support for their implementation. The submission of a comprehensive project report on the Calcutta Leather Complex by the CLRI in 1993 to the Chief Minister of West Bengal was a major landmark in adopting the new concepts of GT for relocation of 450 Calcutta tanneries in an environmentally more compatible location.

Mission Oriented Research for Modernization

The need for a mission mode approach for the modernization of Indian leather industry was realized by GT as early as 1985. He conceived the CLRI Mission on R&D approaches for the leather industry modernization for the 7th Five Year Plan. During this period, extensive scientific investigations were undertaken at CLRI for the upgradation of leather process technologies, ecofriendly process options, process control and partial automation, objective leather quality assessment, chrome and water management in tanneries, resource

assessment etc. The thrust of the mission programme in the 8th Five Year Plan was placed on the application of CLRI developed technologies at the field level.

Encouraged by the industry's response to CLRI's modernization programmes, GT took the major initiative of approaching CSIR and Government of India in 1993 to identify 'leather' as the National Mission. This is mainly to implement the technological inputs of CLRI on a large scale at grass root level in all regions of the country with the committed support of various ministries of the government, industry and voluntary agencies. It is heartening to learn that the Leather Mission programme has received strong support from the government and the project is likely to commence during Feb/March 1994. There is no better tribute to GT's contribution to Indian leather industry than this imaginative and well planned programme to upgrade its status.

International Support for Capability Building

The strong need for the modernization of CLRI's infrastructural facilities was felt by GT during 1985 and his efforts to mobilize international support started straightaway. He took the bold decision of seeking World Bank soft loan for upgradation of CLRI scale up facilities in leather, chemical and footwear sectors. The CLRI had become one of the four CSIR laboratories to borrow funds for applied research programmes and the first to implement and complete the major part of the project (US$ 4 million) with high level of efficiency.

The CLRI has also received support from IDRC, Canada for its efforts to evolve viable alternatives in meat handling systems to improve the quality of hides/skins, from TNO (The Netherlands) for development of technologies for pollution control and chrome management in tanning sector, from the University of Amsterdam (The Netherlands) for conducting special survey on the women's employment potential in footwear sector, from the UNDP for HRD in product sector and from UNIDO for the implementation of ecof] riendly technologies in Indian tanneries.

Quantum Jump in Capabilities in Product Sector

The rapid advances being made by the Indian leather industry in leather product sector particularly in footwear, leather goods and leather garment sectors has brought in the need for CLRI to enhance its research and development capabilities in this sector. GT took the bold decision as early as 1985 to install computer aided design system for footwear at CLRI. It was ahead of times: but the later events have proved the vision behind this initiative. The next major initiative was to approach UNDP/UNIDO for providing a major role to CLRI in the National Leather Development Programme (1992-95). The response to CLRI proposal was positive and accordingly a comprehensive programme with 20 outputs in all the important components of leather product sector was approved in 1992 with US$ 2.6 million financial support and Rs 2.8 crores counterpart funding from CLRI/CSIR. Within a short span of 20 months, the CLRI achieved major success in establishing the country's first shoe fashion studio, state of art pilot scale fabrication and training facilities for footwear, leather goods and garments, international class shoe testing facilities, 30 CAD

centre for footwear, scale up facilities for leather product chemicals etc. The CLRI can now boast of infrastructural facilities and technical expertise in leather product sector which can be compared to some of the best in the world. This programme has also resulted in CLRI's technical and scientific collaboration with internationally known organizations like SATRA (UK), AFPIC/AFPA (France) and OPTIM ER (Hungary).

Innovative HRD programmes

CLRI has been serving as a national and international education and training centre in leather processing since 1950s. GT took major initiative in 1986 to introduce post-graduate degree programme in footwear science and engineering in collaboration with Anna University. This was the first post- graduate degree programme in footwear area in the world. Encouraged by the tremendous public response, he approached the Anna University recently to start similar programme for the leather garment sector. The National Leather Development Programme provided further impetus to CLRI training activities in leather product sector for introducing 2 five level structure programmes with multi entry and exit provisions. GT is also responsible for introducing post B.Sc diploma course in leather technology in 1993 giving credence to the Industry's need for well- trained supervisory level personnel in tanneries.

In house career development of CLRI staff was utmost in GT's HRD priority. The collaboration between BITS, Pilani and CLRI in achieving these goals is unique in CSIR system. Several staff members, who were underqualified as per CSIR's direct recruitment regulations, could benefit from this programme. The CLRI is also recognized as the practice school for BITS in various specialized areas.

Financial Sustainability

The financial sustainability of CLRI received highest attention from GT for its efficient functioning even under adverse financial situations. Concerted efforts were made since 1985 to progressively enhance the external cash flows to the institute with an average annual growth rate of 20%. This is to provide supplementary financial resources to meet the recurring costs of basic and applied research programmes as identified by the Research Council. Simultaneously attempts were made to obtain international funding for infrastructure strengthening in several mission and thrust area programmes. These efforts proved successful with international agencies like World Bank, UNDP, TNO, IDRC etc. coming forward to support industrially important projects. The CLRI has also succeeded in winning a global contract from UNIDO to implement environmentally friendly technologies in Indian tanneries.

Emerging Scenario for Indian Leather- A Forecast

The Indian Leather Industry has set itself a challenging target of achieving 10% share in the global leather market by the turn of this century. The question uppermost in everybody's mind is "Can India take this challenge?" An achievement of this magnitude would call for dynamic actions by the Indian leather sector in mobilizing material and financial resources, upgrading its technologies and skills and developing international marketing

skills. A systematic resource and technology forecasting process has to precede this action programme. The current international trend corroborates CLRI's view that the future growth of leather sector has to be technology driven. GT has been the main architect of TAFILS programme and has shown extraordinary initiative and drive in coordinating this unique exercise for the first time in the leather sector. Several innovations introduced by him in Delphi survey, teleconferencing and NGT have become trend setters for other sectors to follow. As a tribute to his extraordinary contributions to this forecasting programme in leather sector and his outstanding contribution to the Indian leather research and development as Director of CLRI, LERIG-94 is being held in his honor.

As stated earlier, CLRI has been able to establish itself as an international centre of excellence in leather science and technology. Its contributions are sought and quoted extensively and its methods and processes widely used. CLRI has been able to attract funding and collaborative research from many overseas agencies like UNDP, UNIDO, FAO, Commonwealth Science Council and Commonwealth Secretariat, TNO (Netherlands), FRG, SIDA, Australia and erstwhile USSR and GDR.

Encouraged by these trends, CLRI is embarking upon a novel international venture to further increase its role in overseas markets. The CLRI International, an international marketing arm of CLRI and its industrial associates is proposed to be floated as a registered entity. Adequate incentives will be built in for attracting international ventures based on Indian know-how and technology in leather and allied sectors. The dynamism and vision of GT have come to the fore while conceptualizing this novel venture and obtaining industry's total support.

CLRI International on the Offing

GT has visualized commercial arm of CLRI and has christened it as CLRI International. The proposed organization aims to market CLRI technologies in the international leather sector. It is a venture in which many professional bodies, agencies, industrial associations and CLRI are expected to collaborate and enhance the global status of the Institute and its service potentials. This is a novel initiative for any CSIR organization and represents one of GT's innovations in R&D management.

Concluding Remarks

I had the privilege of closely working with Dr. Thyagarajan since 1972 during his illustrious tenures at IICT, RRL, Jorhat and CLRI. I am deeply impressed by his extraordinary management capabilities, commitment to science, dynamism coupled with vision, ability to unite people and institutions, respect for emerging sciences and genuine concern for the welfare. of his friends and colleagues. I do not consider any achievement in my career more exciting and challenging than leading the largest leather research institute in the world i.e. CLRI as a worthy successor to Dr. Thyagarajan.

GT: In the Service of CLRI

(Extracted from Tribute published in 1994)

Dr S Ramachandran, Chairman, CLRI Research Council

GT assumed charge as Director of CLRI on 28 November, 1984. The institute by 1984 had entered a new technological era; an era in which the industry had been galloping in technological advancements. Opinions had been expressed that the technology status in the industry was maintaining a higher pace than that in CLRI. GT's measures reversed the trend and placed CLRI back in the Driver's seat with technological preeminence of the Institute bearing fruits.

GT's era in CLRI will always be a memorable one; for its dynamic approach and forward thinking. The decision to install Computer Aided Design Centre for footwear was bold and ahead of its time in 1986; but then the later events have proved the merit of the Golden Touch of GT. Engineering back-up to the leather industry through a comprehensive service was a new direction that GT chose to build. There have been quantum changes in the nature of number and type of services rendered by CLRI due to the dynamic involvement of GT in CLRI.

The external cash flow of CLRI rose from 25 lakhs in 1984 to 180 lakhs in 1992. Many new International projects were launched in CLRI. His crusade for tannery relocation for the sustainable development of the Indian leather industry gained momentum and received acceptance by the Government of West Bengal. Many new infrastructural facilities were added including an auditorium, dispensary, power back-up, centres of excellence in magnetic resonance, bioinorganic chemistry and chemical engineering. For Industrial risk and safety assessment, a high-level expertise in the Institute has been built; due to the foresighted planning of GT.

The Institute-Industry linkages got further strengthened during his tenure. The industry so that the services of CLRI more often and for larger challenges and assignments. GT added a silver lining to the role of CLRI as the National Apex Body for leather by catalyzing many policy directions of the Government. The National Leather Development Programme under which the trinity of Government-Industry-Research is aggressively engaged in the development of Indian leather sector; GT has added a new dimension.

The World's largest leather research centre became larger and more able under the leadership of GT. The Golden era of CLRI in recent years has been that in which GT has been the Director of the Institute. As the Chairman of the Research Council of CLRI, I had the unique opportunity of closely working with GT since 1991 and contributing to the growth of this premier national institution. The significant achievements of CLRI in the recent past have been

i. Specialty leathers from buffalo hides
ii. Enzymatic unhairing of skin
iii. Microprocessor controlled process technology for vegetable tannin extraction
iv. Process control and partial automation of tannery wet operations
v. High performance syntans (Alutan and Alcrotan) for tanning operations
vi. Basic chrome sulphate with built-in high exhaustion capabilities
vii. Decentralized dead animal carcass processing facilities
viii. Fashion styling and range building of shoes
ix. CLRI-AFPIC modular training programmes in footwear, leather goods and leather garment sectors
x. Shoe testing and comfort assessment through GAIT analysis

These achievements are the culmination of untiring and purposeful efforts of CLRI scientists under the dynamic leadership of GT.

Dr GT and his vision

(Extracted from Tribute published in 1994)

Shri Sanjoy Sen, 24/1 Ballygunj Circular Road, Calcutta 700 016

I had been closely associated with Dr G Thyagarajan for over a decade first in my capacity as the Chairman of the Research Council of the Central Leather Research Institute. Dr Thyagarajan was inducted as Director at a time when due to the absence of a permanent Director the CLRI had become a dormant Institute and the morale of the scientists were at its lowest ebb. It goes to his credit not only to Head this Institute for a decade in an exemplary fashion but also to bring about a sea change in its structure, diverse scientific activities, and work culture. His induction of new blood, departmentalizing different streams of science and providing the leadership for interaction between them on ongoing projects of the Institute was mainly responsible for creating a healthy scientific and R&D atmosphere and creating a sound basis for self-sustained growth.

His pleasant personality and persuasive ways endeared him to the industry especially after he changed the accent at the CLRI to work more for the benefit of the user interest. It is to his credit that he will be leaving the Institute securing for it the largest chunk of external aid as well as industries sponsored earnings which continues to grow year by year till date. Dr Thyagarajan is a man of foresight, vision and to some extent a dreamer. He had been able to initiate several new ideas for modernization of tanning and footwear industries, such as computer-controlled leather processing and computer aided design of footwear amongst others.

During his tenure at the Commonwealth Secretariat, London as its Secretary of Science Council and Scientific Adviser to the Secretary-General, in my many meetings with him during my visits to London, he invariably treated me to lunch or dinner irrespective of how busy he was, as he has always been a very generous person. Though he was connected at that time with the international scientific community and the work was totally different from that of the Leather Institute, he had no difficulty, winning the confidence of the Commonwealth Secretariat as well as the Governments of the countries. The Secretariat was keen to extend his contract but he declined as he was keen to come back home and assume greater responsibilities prior to his retirement.

Though it will be a sad day when he retires from the CLRI, he can feel happy and proud he has left behind a line of command who can take off from where he left off. If his technology forecasting in the Indian Leather sector for the year 2000 and beyond provides ample and new food for thought this will be his parting gift to the leather industry in India. Being active in mind and body I am sure we shall see more of him in the days to come and wish him success in attaining even greater heights.

Dr G Thyagarajan

(Extracted from Tribute published in 1994)

A Sahasranaman

When Dr Thyagarajan joined the Central Leather Research Institute, Madras, sometime in 1985, the leather industry in India was poised for a major transformation. The Pande Committee recommendations had just been accepted by the government and a number of concessions announced to augment the share of value-added products in the export from the country. Great stress was laid on modernization, quality upgradation, design development and marketing of shoes, garments and various leather products. In the years that followed the presence of Dr Thyagarajan as the Director of CLRI played an important role in substantially altering the face of the leather industry in India.

One of the important achievements of Dr Thyagarajan has been in bringing the industry all over the country closer to the CLRI. Though he did not ignore basic research, he was conscious that the industry at that point of time was badly in need of practical support in adoption and assimilation of new technologies. It goes to Dr Thyagarajan's credit that he expanded the vision of the CLRI to cover design and development of various products of leather. The procurement of a Computer Aided Design system in CLRI for footwear in 1986 is a case in point. As a scientist he did not ignore the importance of the Economics Division of CLRI which did some excellent studies during his stewardship. The All-India Survey of hides and skins published in 1986 and the Capacity Utilization of Tanneries in India in 1989 are two pioneering works done. These are important sources of information for the industry today.

Today CLRI can boast of an excellent Chemicals division which has undertaken a number of sponsored research projects. The confidence of the chemicals industry in CLRI has increased considerably. With the loan from World Bank and the assistance from UNDP, CLRI today has established excellent facilities in their CAD systems and training facilities for footwear, garments and leather accessories. A world class Testing facility has been set up in collaboration with SATRA, UK. Many interesting research projects in the areas of developing environment friendly chemicals, all India foot survey, etc. have been taken up under his dynamic leadership.

Dr Thyagarajan firmly believed that the traditional leather industry must change and wipe out its image as a chronic polluter: and, this change could be best achieved if the leather industry could be relocated in well laid out industrial complexes where modern technology could be easily adopted. Though he aired these views as early as in 1987, the first major project of this nature is likely to begin in Calcutta soon only now. That CLRI, under his guidance, prepared the Detailed Project Report for this complex is a tribute to his tenacity.

Personally, I had the good fortune of interacting with Dr Thyagarajan when I was the Executive Director of the Council for Leather Exports and later on his return from London, when I was coordinating the UNDP- sponsored National Leather Development Programme I always found in him a keen listener, a practical scientist-administrator, a dynamic and far" sighted industry leader and above all an extremely likable human being. I am sure that the industry would have the opportunity of utilizing his services even after he retires from service. I wish him and his family very happy and fruitful life after his retirement.

My Unique Experiences with Dr G Thyagarajan

(Extracted from Tribute published in 1994)

P S Ananthanarayanan, 3 Viswesvarapuram, Madras 600 018

My association with Dr Thyagarajan has been under two different contexts. As one of the important clients, I represented Balmer Lawrie as Executive Director to collaborate with CLRI for developing new process technologies for leather chemicals. During this association, I was greatly impressed with his sincerity of purpose and appreciation of the team effort between CLRI and Balmer Lawrie. Discussions with him on the progress of developmental efforts always elicited a rational decision based on ground realities. He had never for once stood on his ego or false prestige to defend a statement. After the successful commercialization of synthetic fatliquors technology of CLRI based on sulpho chlorination route by the Balmer Lawrie, he felt that we should offer this technology to the international clientele. We made a joint presentation at the Paris Leather Fair through a well-designed brochure delineating the features of the technology transfer. I was proud that Dr G Thyagarajan could put India on the international map of technology transfers for leather chemicals.

As the Chairman of the Leather Chemical Manufacturers Association, I had many opportunities to interact with Dr Thyagarajan. I had impressed on him that as a forum, the CLRI had not conferred with the leather chemical industry for chalking out a long-term R&D programme for chemicals. His response was immediate and we had series of meetings between LCMA and CLRI and within a period of one year we had a well thought out programme chalked out. Those interactions brought out the great openness in Dr Thyagarajan to accept suggestions from external agencies for identifying new areas for investigation.

The freshness with which he approached any problem arose from his conviction that suggestions for improvement can come from any source and the purpose for which CLRI as an institute stood should be well understood by the beneficiaries namely the leather, the leather products and leather chemical industries, apart from academic community.

This conviction led him to undertake the latest venture on technology forecasting for Indian Leather Sector for 2000 and beyond. From the list of experts identified for the Delphi round, the thoroughness with which Dr Thyagarajan approached the whole project could be seen.

Dr G Thyagarajan - As I Know Him

(Extracted from Tribute published in 1994)

Dr I S Bhardwaj, Indian Petrochemicals Corporation Ltd, Baroda

In Dr G Thyagarajan, one sees the profile of a science manager, an outstanding chemist, a dynamic administrator and a persuasive marketeer of science and technology. He inherited his organizing ability from his illustrious teacher Dr G S Sidhu and developed it into a fine art. Due to his multidimensional efforts, Central Leather Research Institute has become a cornerstone of Indian Leather Industry and has contributed to the impressive growth of the industry as a major foreign exchange earner for India.

In my view, the most important quality of Dr Thyagarajan is his ability to find and develop people. He is a master craftsman who produces human gems out of uncut diamonds. Very few people have recognized as he has done that, in science particularly, people are the most important resource. He has demonstrated that by providing the right mixture of freedom, motivation and support, ordinary men can be transformed to produce extraordinary results.

Second aspect of his quality is to be constantly in the lookout for new ideas, innovation, and modernization. The quantum jump one finds in the quality of facilities in CLRI during his vibrant tenure as its director is the testimony to Dr Thyagarajan's ability to innovate. Quality leads to demand, more so, if backed by proper projection and salesmanship. This is precisely what Dr Thyagarajan has achieved. The number of collaborations, sponsorships, and consultancy assignments which CLRI has secured as well as the volume of cash inflow shows the success of Dr Thyagarajan's approach. Creative people are not restricted by normal or artificial boundaries in space, time and thought, so is the case of Dr Thyagarajan. He has not limited his activities of CLRI's areas to leather alone but has crossed newer frontiers and opened fresh avenues.

Dr Thyagarajan has been an asset to CSIR as well as to Indian science and technology. Today Indian Science and technology is under tremendous pressure to provide the cutting edge to our industry in facing global competition. Under this situation only the fittest will survive. But then the gauntlet must be picked up and the opportunity should not be missed. Therefore, we need more men like Dr Thyagarajan today to restore credibility of science and technology as a medium to accelerate the growth of Indian industry and economy.

I am sure, his fine example will guide and motivate his successors at CLRI, our scientists and science managers in taking up more challenges with success.

Sustainable Development of Leather Industry

(Extracted from Tribute published in 1994)

Shri M M Hashim, Chairman, IILP, Madras

The very first meeting of mine with Dr Thyagarajan took place on the day the leather industry accorded a welcome reception to him on his occupying the Director's chair at CLRI way back in 1984. Blunt as I have always been in airing my views, I stated in that gathering that at that point of time in terms of technology the CLRI was at least 10 years behind several tanners. That this remark of mine was taken very seriously by him during the stewardship of CLRI. Under his able and farseeing leadership and dynamism, CLRI today has indeed stolen many marches over the industry and regained its pre-eminent position.

Dr Thyagarajan is one of the best administrator-scientists of this country. He could see clearly that the development of leather industry would be sustainable only if the industry were able to get access to the latest in technology in not only leather processing but also in conversion of leather into a variety of leather products such as shoes, garments, etc. When in 1986 the CLRI acquired a Computer Aided Design System for footwear, not many in the industry were convinced; many thoughts that it was premature. Today however the CAD in CLRI is a bustling center with a rush of various kinds of jobs from the industry. There are unmistakable signs of India slowly but surely acquiring the skills for designing footwear for the world market.

In tanning too, computerized process control has been brought into India, thanks to the CLRI. Though the process was imported, the CLRI had to do a great deal of work to adapt it to the local conditions. Today CLRI has developed a technology which is viable for smaller tanneries too. It was Dr Thyagarajan's absolute confidence in CLRI and the industry that led to his contracting a sizeable loan from the World Bank to modernize the tannery and chemicals divisions. The UNDP assistance that came subsequently has been intelligently woven with the world bank assisted projects. Today the competence of CLRI in education and training not only in leather processing but also in designing and making footwear, leather garments and accessories has considerably strengthened; so much so that CLRI is able to offer such services to countries outside too.

As a person, I found in Dr Thyagarajan, an amiable, lively individual keenly interested in furthering the interests of the industry he served. His stint as Scientific Adviser to the Secretary of Commonwealth Science Council at London was notable particularly the way he tried to expose the Indian capabilities to other developing countries. The industry would miss Dr Thyagarajan very much after he retires from CLRI but I hope that the industry would have the opportunity of drawing upon his vast knowledge and experience even after his retirement.

Spokesman for Risk Mitigation and Industrial Safety

Dr. S. Varadarajan[$]
Mr C. H. Krishnamurthi Rao[$]
Mr. G. Swaminathan[$]

[$]Extracted from edited volume brought out in 1994



Thyagarajan: A Dynamic Leader

(Extracted from Tribute published in 1994)

S. Varadarajan, Former Director General, CSIR

I have had the privilege of close association with Dr. G. Thyagarajan in the plans and projects he has conceived and implemented in many capacities nationally and internationally. I first came to know of him from his publications in organic chemistry from the then Regional Research Laboratory, Hyderabad and Regional Research Laboratory, Jorhat. His willingness to shoulder difficult and challenging assignments at an early age was evident from his move to Jorhat. His horizon expanded to cover several new areas such as building materials, mushroom cultivation, petroleum exploration, additives to oil and oil products. To meet the need for sophisticated new pesticides, he was able to motivate several laboratories of CSIR to make an extraordinary coordinated time bound effort in developing technologies and provide successful demonstration of efficient, economical and reliable processes on pilot scale, which were then transferred to several entrepreneurs. The pre-eminent competitive position of India internationally in high value agrochemicals is undoubtedly the outcome of this innovative multi-laboratory cooperation. Success in this scheme was crucial in the evolution of a new positive image for CSIR in the world of chemical industry as a trustworthy, technology-developing agency. Thus, Jorhat not only fulfilled its promise and role in the Region but became a contributor nationally and this was accomplished by G.T. by attracting and nurturing new talents and by enlisting enthusiastic support of all colleagues and by giving due credit to all those working in the laboratory.

By the time Dr. Thyagarajan moved back to Hyderabad as leader of a large laboratory with many interests, he was well known as a technologist and an excellent research manager. He generously shared his experience and concepts with his colleagues in the whole of CSIR. A new effort was made towards international collaboration in development of new drugs as well as in launching new products by several Indian companies.

A successful chain of basic research concept to technology, detailed engineering and commissioning was instituted for chemical products for the first time in a laboratory, again by multi-disciplinary and multi-division cooperation, displacing individual credit by total joint recognition.

Recognizing such unusual combination of talents and committed leadership for recognition of new opportunities, motivation of entire teams for performance and readiness to venture into new unfamiliar areas, Dr. Thyagarajan could be persuaded in 1984 to accept the Directorship of Central Leather Research Institute and move from a large well-established Laboratory with multiple area and product interests to a relatively smaller one devoted to a single area.

Within a short time, CLRI was transformed to modernity and cohesion with high responsiveness in the growing needs of sophistication in leather technology and leather goods design. Dr. Thyagarajan has brought back deep interest in basic open-ended research

while upgrading technology and especially environmental standards. Quite quickly, the laboratory and its scientists have won many awards. Furthermore, connections between basic research and efficient application, have been demonstrated.

Dr. Thyagarajan visited Bhopal in December 1984 after the leakage of the toxic gas and has provided much assistance in the subsequent investigations. True to his nature, he has been able to nurture new effort in the area of surveys of large chemical complexes for risks and higher safety and this has evolved into a major division with ability to compete internationally.

Dr. Thyagarajan was clearly a natural choice to be the Science Adviser to the Secretary General of the Commonwealth Secretariat. He blossomed into an internationally recognized innovator and developer, with unusual combination of powers of perception, persuasion to wield together many national agencies and individuals and funding organizations to participate in tremendously exciting programs of economic, social, scientific and technological development. He created history in the three and a half years in the Secretariat and in all the Commonwealth Countries through ceaseless innovation. He radiated joy for the giver and receiver as well as the facilitator. Thanks to his thoughtfulness. I could share some of the happiness in this creation of entirely new and novel ventures. Not surprisingly, the Secretary General and all his colleagues in the commonwealth secretariat and in many countries persuaded him passionately to continue for some more years in CSC; but he chose to return to India.

Dr. Thyagarajan is exceptional in his willingness to accept change of field and location and to be able to absorb assimilate and further improve with extraordinary speed. Courage and conviction emanating from him, readily generates confidence, trust, regard and loyalty among all his co-workers. He is superb in his presentation of his thoughts and a pioneer in communications methodologies. As a thoughtful and generous person with a sense of humor, he has secured lasting friendships.

Dr. Thyagarajan is a great asset with richness of imagination, sustained dedication and originality in management of creative human resources. He is sensitive to everyone's aspirations and needs. He has much to offer for many years to come and I am certain that we will continue to utilize his vision and energy for generation of wealth and strength in many spheres in the country.

His cheerfulness even in adverse circumstances is an inspiration for all those in public service in India infusing in them optimism and hope for the future. In these efforts, it is fortunate that there is an ardent supporter in Mrs. Thyagarajan for all those who seek guidance and assistance of Dr. Thyagarajan as she is gracious to receive them at all times providing a truly congenial atmosphere.

A Profile on a Prolific Scientist

(Extracted from Tribute published in 1994)

Mr C H Krishnamurthi Rao, Chairman, Chemfab Group of Companies, Madras

It happened when Dr G S Sidhu was the Director-General of the Council of Scientific & Industrial Research, he convened an informal meeting, at the CSIR guest house, Delhi to consider the indigenous development of membranes for chlor-alkali and other process chemical industries, where he introduced Dr Thyagarajan, as a specialist in organic chemistry and is from RRL, Hyderabad. The meeting is still fresh in my memory for the guesto with which Dr Thyagarajan participated in the deliberations and the authentic manner with which he dealt with a technology quite virgin to India. But, the way in which he expressed his reservations on the economic viability of the proposal, it was remarkably subtle as an organic reaction. His persuasions were characterized by deftness, sensitivity, and fine distinction.

Subsequently, I found that Dr Thyagarajan was much in the news with many prestigious awards. That was the time when TEAM was looking for some new product and process technology for their diversification and approached RRL, Hyderabad. I was delighted to find in Dr Thyagarajan, the rare qualities of gentleness and courtesy, albeit being a boss of the Institute. He spent the whole day with me in taking me around the sprawling complex of the laboratory detailing the entire gamut of activities therein. I found his knowledge on any subject is so amazing as to require the latest Encyclopedia to update itself. But more amazing was his congruous and correct reasoning when he declined a particular technology to me. "Mr Rao, I agree that the product is commercially attractive, but the technology is very simple one. I do not want the capabilities of an entrepreneur who could make the success of an intricate technology as Titanium Anodes should abdicate his abilities in simple technologies. I may prefer releasing it to a less endowed entrepreneur". Although it was averse to my wishes, my admiration for him increased. I could find a man pervading with a spirit converging with the broad vision of the founding father of the national laboratories. This spirit is rare to find with a specialist, because it is stated that a specialist is one who knows more and more on lesser and lesser fragments of a particular subject to forget the larger context. Here is a man in Dr Thyagarajan where there is a fusion of mission and purpose; synthesis of wisdom and knowledge. These are the qualities that the Bhagawat Gita distinguishes as "GNANAM VIGNENA SAHITAM".

The spirit of technological adventure and pioneering have marked the CLRI, since the days of its establishment. Ever since Dr Thyagarajan's assumption as the Director of CLRI, the industry and technology has grown in depth and sophistication. An obnoxious trade where degradation in the human context is considered inevitable, has been transformed into a respectable one. The squalor conditions of trade had been basically altered in the last one decade due to the science and technological inputs provided by the institute. The Institute has now become a Vatican or Mecca to the international leather technologists. It is a well-known fact that India does not have much of a presence in any major field on the international arena. Besides, the Annual Leather Fair at Madras has also lured the

international leather trade visitors, thanks to the strength and quality of the technology provided by CLRI to change the complexion and texture of the trade. It is only during this decade, since Dr Thyagarajan is at the helm of CLRI, that value-added leather products has become the mainstay of India's export trade. As a matter of fact, the Indian currency has been stabilized at the international levels due to the performance of the leather trade, as a major player.

The scientific and industrial community may recall that the first red rag of pollution was directed against the effluents of leather industries. It is an inevitable consequence where offal wastes are tanned, treated, and transformed into precious wealth. Dr Thyagarajan is an environmental evangelist, but not of the emotional cadre as Bahuguna or Mata Patkar. But a rational and practically oriented environmentalist who believes that pollution is not the product of the industry, but inadequacy of technology. Therefore, he concentrated more on the solution to the problems, inspired inventions than crying hoarse on the damages. My interaction with Dr Thyagarajan during his tenure as the Director of the CLRI is mainly on environmental matters. He has built up a team and got accreditation to the CLRI as a safe and dependable Institute for taking up the risk analysis of any environmentally hazardous industry.

The services he rendered in different parts of the world are enormous and wide. The honors he received from different universities and professional bodies are numerous. These proud distinctions really make him a scientist of international order. Only a few great men of genius have scaled this height.

Dr Thyagarajan's achievement lies in elevating Indian leather as the international cadre by making it more supple, more pliant and with greater sheen. It is my suppliant wish that our country should continue to have for many years, the strength of his wisdom and the guidance of his genius, so that India may prosper in science, technology and industry with greater strength and sheen.

Dr. G Thyagarajan: A Visionary with a Missionary Zeal

G. Swaminathan, Former Chief Scientist, CSIR-CLRI, Adyar, Chennai 600020

I can confidently say based on my long innings in CLRI, that I had several opportunities to interact with all the Directors of those times. I was very fortunate to interact more with Dr. G Thyagarajan as soon as he became the Director of CLRI since he was the one who started the Cell for Industrial Safety and Risk Analysis (CISRA) as part of the newly formed Chemical Engineering Department. It is superfluous to state here that he was a member of the investigating committee of the devastating Bhopal Gas Tragedy which propelled him to start a deep study and analysis of all chemical and related industries handling flammable, explosive, and toxic chemicals and processes. He had met me on many occasions at the Education and Training Division and once asked me to visit a chemical factory in Pondicherry to give them some insight and advice to the engineers in solving some problems relating to process safety. I was not even inducted into CISRA at that time.

His trust in the scientists and the way he encouraged the CISRA group with Dr. KV Raghavan and Dr. MM Mallikarjunan were something exceptional. He had reposed faith and confidence in me by giving me the assignment of editing the Proceedings of the International Conference on Hazard Assessment and Disaster Mitigation in Petroleum and Chemical Process Industries with Dr. KV Raghavan conducted at CLRI and later published by Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi (1996).

Whenever I took the final report of any Risk Analysis project he particularly would look into the recommendations on safety and reiterated that 'No compromises should be made on safety aspects.' So also, was Dr. Raghavan. I remember clearly one incident where I had to visit and provide a Risk Assessment report on the transfer of a highly flammable hydrocarbon in one of the Andhra Ports. After I visited the port facilities, I felt that it was not at all safe for transfer operations because of the geography and safety conditions there; when I made several strong recommendations to the popular client, he and Dr Raghavan fully supported them which ultimately made the client to withdraw his proposal, which indeed, was a wise decision.

I find his language both in communication and writing used to be crisp, precise, and also convincing. I have never seen him use extra words to drive home his point.

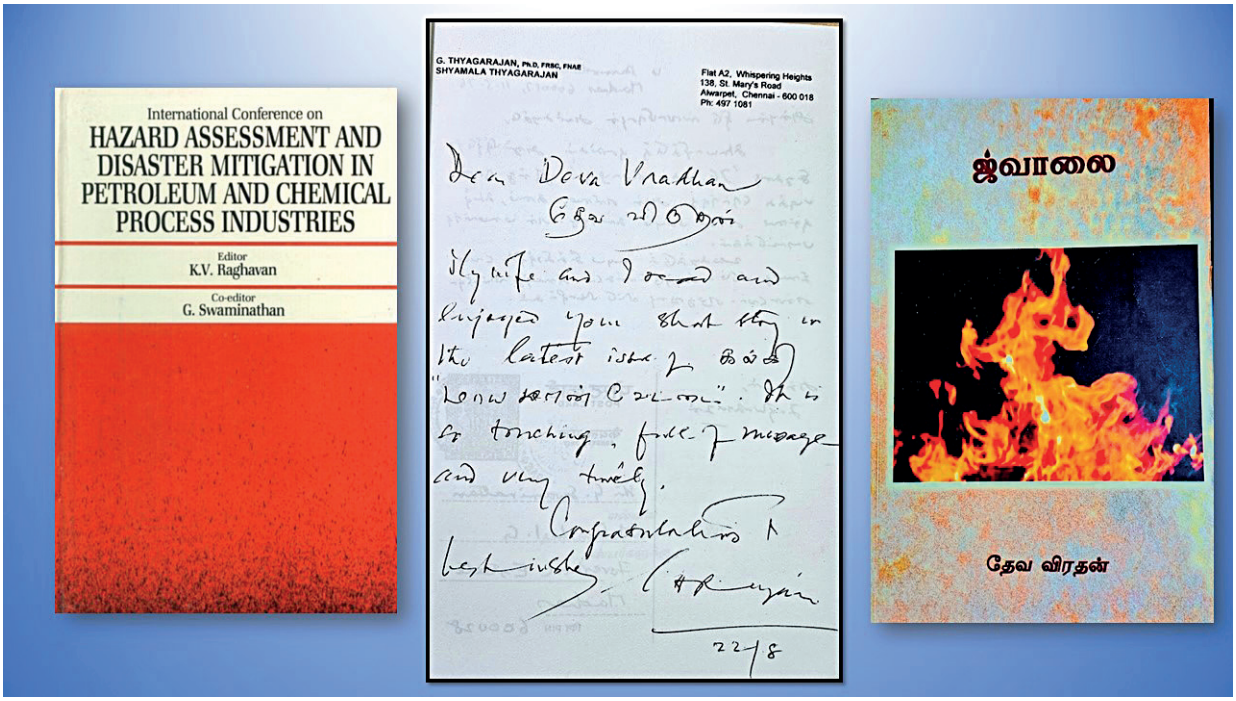
Dr. GT held various enviable positions in his illustrious career. For all that I found him as an easily approachable down-to-earth person who respected everyone and performed all his positions with great dignity and foresight. I remember him bringing the dispensary, crèche, clean roads, bright illumination inside the campus, completely remodeling the guest house, and constructing an auditorium for CLRI.

I owe him personally because I was immensely benefited by the Chemical Engineering department he created and more especially CISRA, the Cell for Industrial Safety and Risk Analysis. In my entire career, the best period of my life was dedicated to that active

and illustrious wing of the Department. I was given opportunities to work for large petrochemical industries like IPCL. HPCL, BPCL, and CPCL apart from several other industries like Pharma, Pesticide, Fertilizer, Chlor-alkali, and Metal Powder factories to name a few. Dr. KV Raghavan's role also was very significant there in shaping my career. Through his reference, many training programs were conducted for the National Safety Council and also for several individual industries. He promoted our skills and ability to take safety aspects to all industries through those Training Programs.

Dr. GT apart from his academic and administrative excellence, was a man who personally cared for others and respected others' talents. My personal rapport with the Thyagarajan was on a different plane. I was, indeed, surprised when I received a letter of appreciation from him when my short story titled 'Maya Maan Vettai' (மாயமான் வேட்டை) was selected for a prize in the short story competition in Kalki (a popular Tamil magazine) and later my meeting with him. I considered it a privilege to keep his letter as the Foreword when I published my first collection of short stories titled 'Jwaalai' (ஜ்வாலை). Later, he read almost all the short story collections I gave him and offered his precise observations and comments. He never failed to compliment my Concert Reviews in the 'Friday Review ' of The Hindu. Dr. GT and his wife Mrs. Shyamala Madam always acknowledged my writing skills both in Tamil and English and both felt happy to share their interest in classical music. I can never forget the bonhomie they extended to me when I visited their home a couple of times. He was a good speaker, conversationalist, guide, motivator of talents, and also a real visionary.

Dr. GT's life is an enlightening and remarkable journey for many who want to grow, achieve, follow their interests in many fields, and be successful in their lives.



Transition of a Scientist into a Science Diplomat

Shri M M Hasan[$]
Dr M S Chadha[$]
Dr B N Desai[$]

[$]Extracted from edited volume brought out in 1994

Dr G Thyagarajan

(Extracted from Tribute published in 1994)

Shri M M Hasan, Scientist, Indian Institute of Chemical Technology, Hyderabad

I had the good fortune to work and be associated with Dr. G. Thyagarajan closely over many years. I shall highlight my association with Dr Thyagarajan when he was the Scientific Advisor to the Secretary-General, and I was Project Officer at the Commonwealth Science Council in London during 1988-90. I consider myself to be privileged for having worked with him in this position at London and as such the experience was unique.

Dr Thyagarajan was selected to this coveted post of Scientific Advisor to the Secretary-General, Commonwealth and joined CSC in December 1987. The fact that he is the first Indian to be chosen to occupy this responsible and prestigious post and the fact that he was selected in an open competition from among 49 Commonwealth countries including Britain, Canada, Australia, New Zealand, speaks for itself the esteem in which Dr Thyagarajan was held amongst the Commonwealth countries. Dr Thyagarajan was responsible for bringing about a change in the functioning and image of CSC which became vibrant and responsive to the aspirations of the member countries.

Dr Thyagarajan reorganized and reoriented the working at CSC, primarily with the three major objectives in mind:

- Formulation of impact - making major programs.
- Formulation of programs relevant to the development of member countries.
- Enhancement of collaboration among member countries as well as with other international agencies.

Impact making major projects

The Caribbean Oceanographic Resource Exploration (PROJECT CORE) is a fine example of a major scientific program undertaken and successfully completed by CSC during Dr Thyagarajan's time. The project was carried out with an active scientific collaboration with India by way of providing the Research Vessel "Sagar Kanya" free of cost as well as training 22 Caribbean Scientists at NIO, Goa. Project Core was a major significant activity of CSC which created a great impact and was a fine example of scientific collaboration among the member countries of the Commonwealth. During the project, Dr Thyagarajan was in full command of the operation as a result of which the cruise was successful.

Projects relevant to development of member countries

Dr Thyagarajan paid equal attention to initiate projects which were of direct and immediate interest and utility particularly in the developing countries. Some of the significant projects under this category were;

Chemical Research and Environmental Need (Project CREN)

This project was taken up as an Asia-Pacific initiative towards understanding chemical changes in the environment to seek answers to the consequences of chemical pollution.

Management of Hazard Wastes

Recognizing the importance and relevance of issues relating to hazardous wastes in member countries, Dr Thyagarajan initiated a project in collaboration with Royal Society of Chemistry, London. The initiative received additional impetus from the Langkawi Declaration when the Commonwealth Heads of Government resolved "to act collectively and individually to strengthen international action to see management and disposal of hazardous wastes to reduce trans-boundary movements particularly to prevent dumping in developing countries". As a result of this initiation, six regional centres at Australia, Canada, St.Lucia, India, Kenya and Nigeria were set up and necessary activities commenced.

There are many projects and programs that Dr Thyagarajan undertook during his tenure which had a far-reaching impact within and outside the member countries of the Commonwealth. I consider the meeting of the Ministers responsible for science and technology in commonwealth countries held in Malta in November 1990 as a real feather in the cap of Dr Thyagarajan. It may be mentioned that this was the first time that a meeting of the Ministers for Science & Technology of the Commonwealth countries took place and this was made possible after strenuous and sustained efforts made by Dr Thyagarajan to make this happen.

By the end of this meeting, CSC had attracted the full attention of the member countries and other international agencies and had attained the capacity and stature for vigorously formulating major technological and scientific programs for the Commonwealth countries. Dr Thyagarajan, at that time was at his pinnacle of performance at CSC. At this juncture, it came as a rude shock to all of us at CSC, when it came to be known that Dr Thyagarajan had not accepted the offer of a 4-year extension to him to be the Scientific Advisor to the Secretary General of the Commonwealth. I do not know what and who prompted him to leave the CSC and come back to CSIR, India.

I take this opportunity to wish Mrs and Dr Thyagarajan many years of peace and prosperity

Dr G Thyagarajan - A Visionary and an Executor Par Excellence

(Extracted from Tribute published in 1994)

Dr M S Chadha, Bhabha Atomic Research Centre, Bombay 400 085

I have had the privilege of working closely with Dr G Thyagarajan during his tenure as Secretary, Commonwealth Science Council, London (1987-90). My association with him was in terms of preparing a background paper for a proposed Regional Symposium on Chemistry and the Environment to be held at Brisbane, Australia in 1989. A brief resume of this effort which resulted in a very successful symposium, a well-received publication of the Proceedings of the Regional Symposium and evolution of the Regional Project entitled Chemical Research and Environmental Needs (CREN), all under the aegis of the Commonwealth Science Council, London will illustrate the subtle and effective way Dr Thyagarajan has richly contributed to this all-important programme in commonwealth countries of the Asia-Pacific region.

Background Paper

As a follow up of the decision taken at the 5th Meeting of the Asian Coordinating Group for Chemistry (ACGC-V) held at Bombay during February 8-10, 1988, Dr Thyagarajan undertook the task of organizing a Regional Symposium on the 'Chemistry and the Environment' by the Commonwealth Science Council, London with UNESCO support. For this purpose, he commissioned Dr T Ramasami and Dr M S Chadha to prepare a background paper "Chemistry and the Environment" and the same was brought out as a CSC Technical Publication (No.CSC(88) 156-35). But for the overall guidance and the reference material provided to us by Dr Thyagarajan and his constant interaction with us (TR and MSC) this background paper would not have been possible.

Regional Symposium - Brisbane, September 1-2, 1989

Dr Thyagarajan decided that a Regional Symposium be held at Brisbane, Australia, on chemistry and the environment in conjunction with the 3rd Asian Chemical Congress and Chemistry International Conference. The Secretary of the Congress Dr B N Noeller and Dr M S Chadha were nominated by him to act as the coordinators of the Symposium. He offered close guidance to evolve a comprehensive programme for the symposium. This two-day symposium was addressed by eminent scientists in chemical aspects of environment from Australia, Canada, India, New Zealand, Malaysia, and Bangladesh. It was largely due to Dr Thyagarajan's reputation as a scientist and an organizer that the response to the regional symposium was enthusiastic and overwhelming. The Symposium was inaugurated by Dr Thyagarajan and after brief remarks by Dr T Spurling, president, Federation Asian Chemical Societies, Professor H Thier, Director of the Chemical Education for Public Understanding (Univ. of California, Berkely) and Dr D Connell, Chairman, Environmental Chemistry Division, Royal Australian Chemical Institute, the symposium took off to a flying start. It was decided that this successful regional symposium should be documented in the form of a Commonwealth Science Council Proceedings.

Proceedings of Regional Symposium Chemistry and the Environment

Dr Thyagarajan nominated Drs B N Noeller and M S Chadha
to edit the proceedings of the Brisbane symposium.

The Proceedings volume (CSC-(90)EPP-16 Technical paper 280) was brought out in record time and that too was possible due to the continuous guidance of Dr Thyagarajan and his excellent liaison with various agencies of CSIR, India in general and Publications & Information Directorate, New Delhi, in particular.

Dr Thyagarajan's FOREWORD to this handsome book is reproduced below to bring out his involvement in this effort. "On 1 and 2 Sept 1989, the Commonwealth Science Council, acting in cooperation with the Federation of Asian Chemical Societies, UNESCO and other regional and international agencies organized a Symposium on Chemistry and the Environment during the Chemistry International Conference in Brisbane, Australia. The Symposium sought to bring together eminent scientists to identify and discuss major environmental issues of consequences to the Asia-Pacific region having a direct association with chemistry.

Earth's atmosphere is influenced by several chemical reactions involving many chemical species. An understanding of the chemistry of the environment, therefore, has many-fold ramifications and implications. To an academician, chemistry of the environment could be curiosity. To the humanity at large, this understanding is vital to preserving the environment through policy initiatives and legislative measures. The chemical dynamics of the earth's environment constitutes a fascinating and scientifically exciting field of endeavor. It is one of the underlying themes in the International Geosphere Biosphere Programme: "To describe and understand the interactive and physical, chemical and biological processes that regulate the total Earth system, the unique environment that it provides for life, the changes that are occurring in this system, and the manner in which they are influenced by human actions".

Presentations and discussions in the Symposium covered a wide range of topics which included the International Geochemical Mapping Project, fossil fuels utilization, ozone hole, greenhouse gases and effects, specific environmental impacts and several chemicals, atmospheric and urban air modelling, major chemical accidents, and environmental monitoring aspects. Scope for regional and international cooperation was discussed in a forum, because of which an Asia-Pacific regional project on Chemical Research and Environmental Needs (CREN) is being set in motion.

The Commonwealth Science council was fortunate to secure the combined association of Dr MS Chadha and Dr B N Noller for editing the papers presented in the Brisbane Symposium. They were easily the natural choice having co-organized the Symposium itself successfully. I am profoundly grateful to both. It is a pleasure to acknowledge the excellent cooperation extended by the Council of Scientific & Industrial Research, India by Dr P Mitra, FRS, Director-General, Dr G P Phondke, Director, Publications & Information Directorate and Mr K N Johry, Head, ISC, CSIR for enabling this publication to be

produced in such a short time and at a reduced cost. The Commonwealth Science Council is pleased to make this publication available to students of the environment, scientists, policy makers and the wider international community concerned about contemporary environmental issues".

Project CREN

As mentioned in his foreword to the proceedings volume, it was Dr Thyagarajan's desire to evolve an Asia-Pacific Regional Project on Chemical Research and Environmental Needs (CREN). He called a meeting in August 1990 in Kuala Lumpur and the aims of this meeting are best illustrated in Dr Thyagarajan's own words, which follow: "In pursuance of the recommendations of the Brisbane Symposium and considering the felt need to enhance awareness on the role of chemistry in development and environmental issues particularly in developing countries and to encourage positive action for environmental protection, monitoring and control the Commonwealth Science Council has planned to initiate project 'Chemical Research and Environmental Needs' (CREN) - as a regional activity for Asia-Pacific. The project would aim to improve our understanding of the chemical make- up of the environment and the relevant research and development with particular emphasis on procedures and techniques for environmental monitoring. The enclosed project circular outlines the project scope and structure.

The project activities are proposed to be carried out through National Coordinators. A plan of action will be discussed and finalized in a Project Planning Meeting to be held on 27 and 28 Aug 1990 in Kuala Lumpur, Malaysia. The enclosed Project Circular gives additional details of the Project Planning Meeting. CSC will present a draft project proposal for consideration and finalization in the Planning Meeting which is being prepared by Dr MNG A Khan, London".

To this meeting representatives from Australia, Bangladesh, Britain, India, Malaysia, New Zealand, Papua New Guinea, Pakistan, Singapore, Sri Lanka and Commonwealth Science Council, London were invited. As a result, a Project with 7 components and lead countries as shown in brackets viz. Atmospheric Acidification (Australia); Environmental Impact of Fertilizers (Bangladesh); Gaseous Emissions from Agricultural Sources (India), Pesticide Residues (India); Chemical Transport Processes and Sediments in Rivers (Papua New Guinea); Air Pollution Modelling (Singapore) and Environmental Analytical Techniques (Malaysia) were identified. Regional Coordinator for the project (Dr B N Noller), National Coordinators, Component Coordinators and Project Advisors were also named.

The fact that the project CREN is an ongoing activity and is annually reviewed and continues to receive patronage from the Commonwealth Secretariat and active support from Dr U OD Trotz, Secretary, CSC, (Dr Thyagarajan's successor), Dr J A J Perera, Project Officer is testimony to the fact that Dr Thyagarajan has the vision to conceive a very large programme, has the charm and personality to attract people to do their best to make such a programme a success and has the concern and continued interest to nurse the effort fondly. Project CREN is just one of the many examples where Dr Thyagarajan has been involved in carrying a programme from the cradle to its full maturity. He has many other glorious achievements to his credit.

Dr G Thyagarajan - An Ambassador of Indian Science

(Extracted from Tribute published in 1994)

Dr B N Desai, Director, NIO, Goa

Great men of science and technology are known for their mission, vision, passion, and compassion sensed by their colleagues. I have had the opportunity to be associated with Dr G Thyagarajan over a couple of decades, and my appreciation of these professional attributes of him is profound. A man of outstanding scientific ability and integrity, Dr. Thyagarajan commands highest respect in India and abroad, as a great scientist. technologist and administrator. The scientists of the Central Leather Research Institute (CLR I) would elaborate the academic and career credentials of Dr Thyagarajan at length. My interaction with him as a fellow Director has always been more than enjoyable. His studious approach, modest disposition, administrative talent and practical wisdom are worth emulating by his peers and the younger generation.

I was pleasantly surprised to observe that although Dr Thyagarajan's professional roots are deep in organic chemistry and leather technology, he brought enormous interest in ocean sciences. India's enviable capabilities in the maritime front fascinated him so much that during his tenure as Secretary, Commonwealth Science Council (CSC) and Science Adviser to the Director-General, CSC, London, he formulated the internationally acclaimed, unique and far-reaching project called "The Caribbean Oceanographic Resources Exploration (CORE)".

It was a grand initiative in South-South cooperation. The purpose was to develop a core of trained oceanographers ·in the Caribbean commonwealth countries using the capabilities of a developing country. This one-million US Dollar CORE project demanded close coordination with the Government of India (National Institute of Oceanography (NIO/CSIR), Commonwealth Secretariat, Caribbean Community Secretariat and the Organizations of Eastern Caribbean States. Under this project, twenty-two Caribbean scientists had three months of intensive exposure to all aspects of oceanography in India. Following this, a multi-disciplinary cruise for exploration and assessment of the resources in the Exclusive Economic Zone (EEZ) of the Caribbean was conducted using India's Oceanographic Research Vessel 'Sagar Kanya' of the Department of Ocean Development (DOD). Scientists from fourteen Caribbean countries along with NIO's scientific team participated in this cruise. It was a massive operation. The outcome and benefits were enormous - an integrated database pertaining to the geological, physical, chemical and biological oceanography of the Caribbean, practically – trained manpower, and above all, international goodwill essential in cooperative and collaborative research in a field science like oceanography.

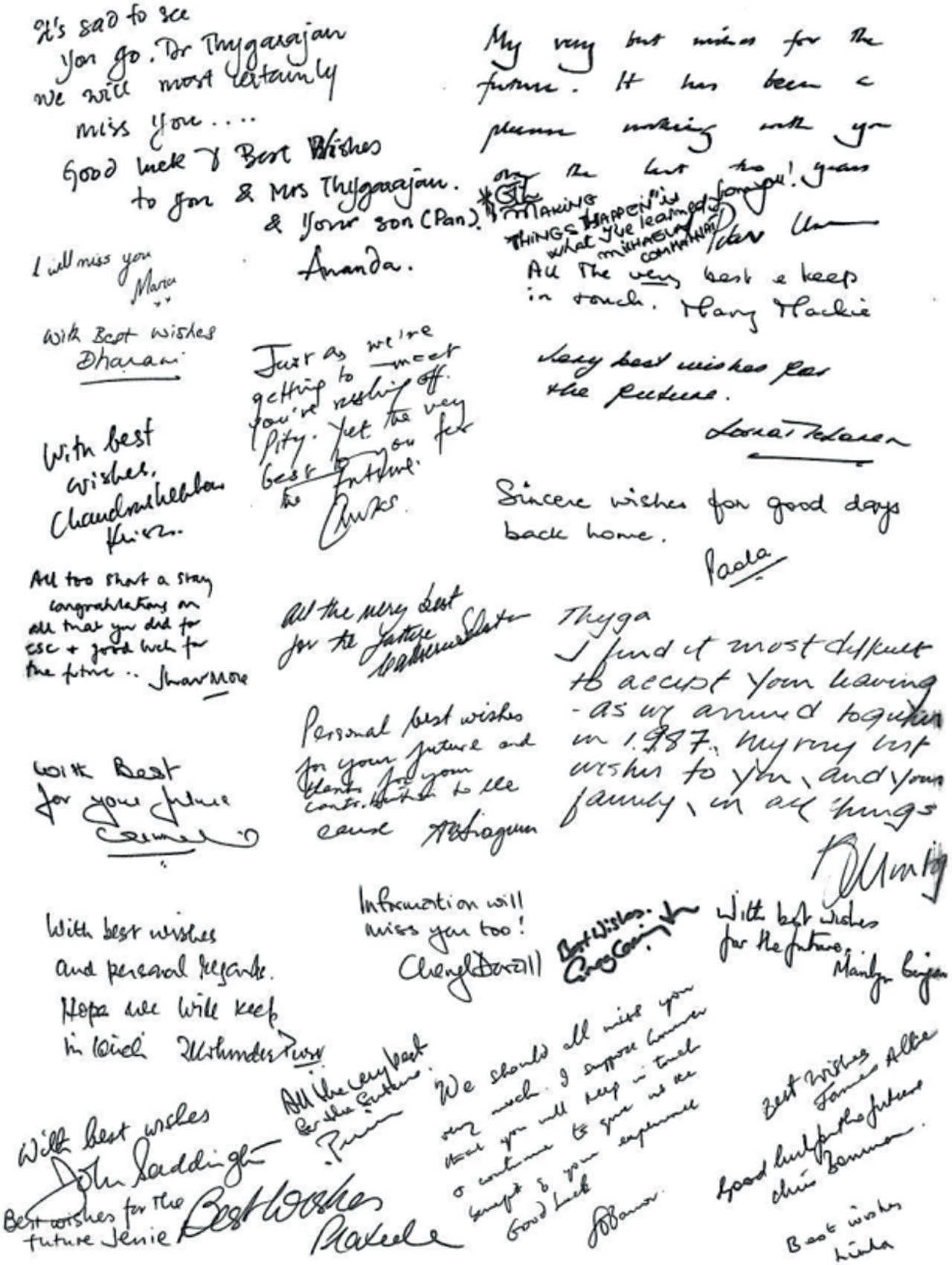
The CORE project stands testimony to the technical, organizational and interpersonal skills of Dr Thyagarajan. I saw him in action during the preparatory period at NIO and the formative stage at CSC. During our visit to the Caribbean countries to mobilize regional support to this programme. I saw him interacting with the highest authorities of the

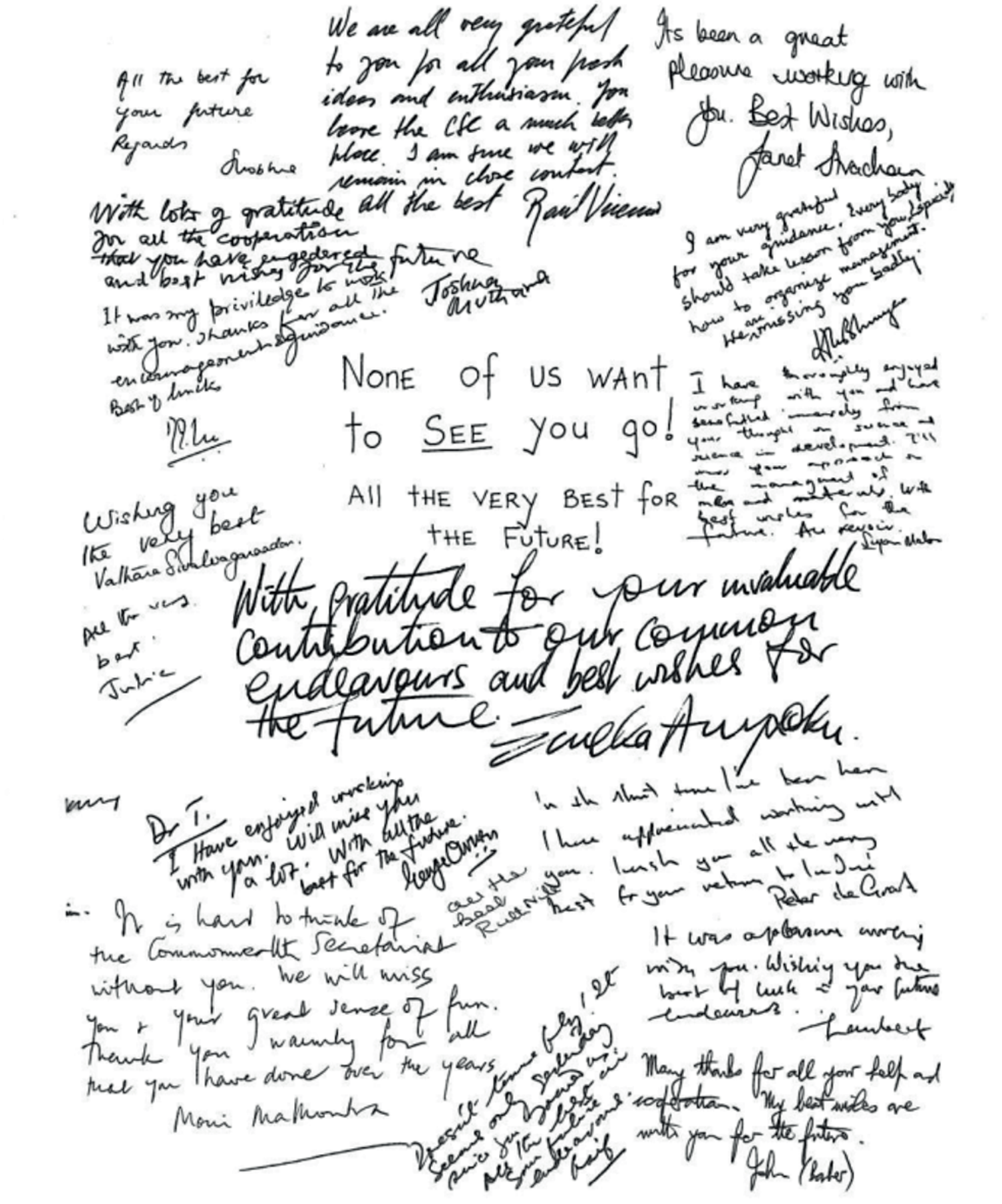
respective countries – heads of states, heads of governments, heads of scientific institutions and heads of diplomatic missions - with such an ease, confidence and self-respect. He knew India could do it. His faith in my Institute made us rise to the occasion - and we did it. CSIR reported "THE CORE project not only blazed a new trail in South-South cooperation, it also proved the capabilities of Indian marine scientists" (Science Reporter, 30(4), April (1993). Dr Thyagarajan gave NIO an opportunity to prove itself to the world at large, and to Commonwealth community in particular. Dr Thyagarajan also saw to the follow-up of the scientific cooperation - joint study of the cruise data and technical assistance from NIO to Jamaica and Trinidad and Tobago in the field of aquaculture and coastal oceanography, in the following years. All these on the face of stiff competitive deportment of the developed nations. My colleagues would agree with me that it was not a small feeling when our ship proudly rode the waves of western Caribbean overlooking a super power nation of super presence.

Dr Thyagarajan was also the Chairman of the CSIR's Golden Jubilee Celebrations in 1991- 92, Golden Jubilee Year saw a host of symposia, seminars and workshops of national and international significance. Dr Thyagarajan's interest in oceanography was once again responsible for the Ocean Technology Conference held at NIO. This was indeed a milestone in Indian Oceanology. His presidential address on that occasion was thought-provoking and inspiring. This prepared ourselves to the challenges of the 21st Century. India's commitment to regional cooperation, resources sharing among developing countries and technological excellence was underlined once again.

Dr Thyagarajan's research interests have been as varied as the positions he held in his scientific career. We could derive the best out of our constant association and I would cherish this throughout my life. I am sure that the benefit of his experience will continue to be available to all of us for a long time to come. Dr Thyagarajan will be remembered as our fellow scientist who spread our name and fame over seven seas.

Warm Farewell Message to a Science Diplomat at the time of his leaving the assignment at Commonwealth Science Council (Extracted from Tribute published in 1994)




All the best for your future
Regards
Joshua
We are all very grateful to you for all your fresh ideas and enthusiasm. You leave the CFC a much better place. I am sure we will remain in close contact.
All the best
Rail Vincent
It's been a great pleasure working with you. Best Wishes,
Janet Strachan
With lots of gratitude for all the cooperation that you have engendered and best wishes for the future
Joshua Muthaura
It was my privilidge to work with you. Thanks for all the encouragement & guidance.
Best of luck
I am very grateful for your guidance. Every body should take lesson from you especially how to organise management. We are missing you badly.
None of us want to See you go!
All the very best for the future!
I have thoroughly enjoyed working with you and have benefited immensely from your thoughts on issues of women in development. I'll miss your approach on the management of men and interests. With best wishes for the future. Au revoir.
Wishing you the very best
Valthara Sivalingasadan.
All the very best
Julie
With gratitude for your invaluable contribution to our common endeavours and best wishes for the future.
Dr T.
I have enjoyed working with you. Will miss you a lot. With all the best for the future.
Regards
In the short time I've been here I have appreciated working with you. I wish you all the very best for your return to India
Peter de Groot
It is hard to think of the Commonwealth Secretariat without you. We will miss you & your great sense of fun. Thank you warmly for all that you have done over the years
Moni Malhoutra
It was a pleasure working with you. Wishing you the best of luck & your future endeavours.
Lambert
Many thanks for all your help and cooperation. My best wishes are with you for the future.
John (Baker)

Champion of the Cause of Science for Small Nations

Dr Tabassum Jamal

Dr. Gopalakrishna Thyagarajan (2 May 1934 - 24 March 2024)

Dr Tabassum Jamal, Chairperson, Zaheer Science Foundation

Dr. G. Thyagarajan has been a member of Zaheer Science Foundation since the inception of the Foundation in 1970. He served as Chairperson of the Foundation during 2016-2020 and contributed significantly to connect scientific and technological developments for societal needs and promoting scientific temper at large, which has been one of the main objectives of the Foundation. He also inspired the Foundation to work in the area of S&T Policy analysis, science for Small Nations and South-South Cooperation through seminars and conferences at national and international level, helping in disseminating the scientific knowledge and promoting scientific temperament for national building.

Under his chairmanship an international conference "Science and the Small Nations-Bridging the Gaps: A Science diplomacy initiative" was organized at New Delhi 2017. The conference was designed to champion the cause of the Small Nations in the global science and society with focus on resource-based or technology driven economic growth. Being a dedicated Science Diplomat, Dr. Thyagarajan always emphasized that there is an urgency to bridge the science gaps through appropriate policies, projects and human resources development needs.

Dr. G. Thyagarajan, a legendary and distinguished scientist, will always be remembered as an institution builder, and an international ambassador for the cause of Science and Technology. He will always remain and inspiring example for the Young Scientists.

For me it is a matter of great pleasure and pride to be associated with him at Zaheer Science Foundation and knowing him personally as a great human being. The Foundation will fondly remember him for his significant contributions and as one of the well-wishers.

In the remembrance of Dr. G. Thyagarajan, the Conference Hall of the Foundation has been named after him. This conference hall hosted a number of events focusing on Science for Society and promoting scientific temperament.

Dr. G. Thyagarajan at the forefront during International Conference on "SCIENCE AND THE SMALL NATIONS Bridging the Gaps: A Science diplomacy Initiative" during November 14-16, 2017 at India Islamic Cultural Centre, New Delhi