COLUTHUR GOPALAN
28 November 1918 — 3 October 2019
Gopalan was a brilliant medical student. The Bengal famine of 1942 made him decide to devote his career to ‘the investigation and mitigation of the nutrition-related problems of Indians, especially those of the disadvantaged sections’. He was the first Indian to win a Nuffield Foundation research scholarship to study in England in 1946. In less than three years he had earned a PhD as well as a DSc in nutrition. He returned to India and joined the Nutrition Research Laboratory in Coonoor. His studies over the next decade showed that, contrary to the global belief, both kwashiorkor and marasmus were manifestations of protein energy malnutrition. His research studies on improving the nutritional status of pregnant women and children with food supplementation led to the initiation of India’s Integrated Child Development Scheme and Mid-day Meal programmes. India’s National Anaemia Prophylaxis Programme and Massive Dose Vitamin A Supplementation Programme were also initiated on the basis of the studies he led.

As Director General of the Indian Council of Medical Research he created institutions to undertake research in the areas of neglected tropical diseases and medical statistics. He initiated the National Talent Search Scheme to ensure adequate human resources for medical research. After he retired, he set up the Nutrition Foundation of India, to continue with policy and operational research studies on the triple burden of malnutrition. He initiated the setting up of the Nutrition Society of India and the Federation of Asian Nutrition Societies to improve networking among nutrition scientists. In reply to a query on his major contributions, he said: ‘I helped to get Nutrition Science in India the recognition it deserved, and I built institutions that will serve the people of India long after my lifetime.’

* premaramachandran@gmail.com
Coluthur Gopalan was born in Salem, India, in 1918. His father was in the police service in Madras. Gopalan grew up in an orthodox joint family under the watchful eyes of a disciplinarian father and a lenient and indulgent mother. The household was always bustling with siblings, cousins, aunts and uncles. A stream of more distant relatives and visitors would come and go.

At the local primary school, Gopalan proved to be a very industrious student. He excelled at mathematics and English. His father was pleased, though always careful not to be too effusive in his praise! In the 1920s, neither homes nor schools in Madras had electricity connections. Like all children in that era, Gopalan studied during daylight or by the flickering light of kerosene or oil lamps. Gopalan could clearly remember when the family got its first electric light, and its first ceiling fan.

At the age of 10, Gopalan moved from a local school to the Madras Christian College School, famous for its quality of education, its eclectic student population and a visionary teaching faculty, many of them Englishmen. There, he was exposed to a microcosm of the wider world. Young Gopalan ventured into elocution and recitation competitions and was soon winning prizes regularly. These consisted of books—classics by Dickens, which were dutifully read, and volumes of poetry by Keats and Tennyson, which were read with great joy. Somewhere along the way, the decision was made that he would study for a career in medicine; neither Gopalan nor his family ever regretted it.

**Medical college in Madras (India) and PhD in London (UK)**

Gopalan joined Madras Medical College, and rode his bicycle to college every day. The teaching faculty consisted mainly of British doctors, many of them excellent teachers. Given the high work load and the challenging competition, Gopalan wanted to put in long hours at home studying. Though the house had an electric connection by then, there was strict rationing of electric power, and so the couple of lights and fans had to be used sparingly. Gopalan’s father explained the problem to the British officer concerned; the electricity allocation was doubled thereafter. Recalling the conditions while he was growing up, Gopalan often remarked, ‘it is only when you have lived without something that you can really appreciate its value.’

Gopalan’s medical college years were spent on the cusp of important events, in his own life, in India and in the world. In 1940, Gopalan married Seetha Srinivasan. It was an arranged marriage, as were most alliances at the time. This was also the year he graduated with a medical degree near the top of his class, and started his training as a house surgeon. He went on to obtain his MD degree. World War II was going on; in 1943 Madras was bombed by the Japanese forces. Some of Gopalan’s family members moved out of Madras, but he stayed on and continued to work in the hospital. Gopalan was keenly aware that India was fighting to attain independence, and he attended public meetings at which gifted orators and dedicated freedom fighters exhorted Indians to throw away their yoke and seek independence.

The bustling government hospital in which he worked had a large case load of patients. Based on data from his clinical observations, he wrote a paper on ‘burning feet syndrome’,
first described by J. Grierson more than a hundred years earlier (1), which was published in the Indian Medical Gazette in 1946 (2)*. The syndrome was subsequently named ‘Grierson–Gopalan syndrome’.

Gopalan also had ample opportunity to observe and treat cases of kwashiorkor, keratomalacia, rickets and osteomalacia, beri beri, pellagra, severe iron deficiency anaemia and goitres. In 1943 the Great Bengal Famine killed an estimated 2.5 to 3 million people—far more than all the lives lost in World War II. This was the turning point when Gopalan decided to devote his medical career to ‘the investigation and mitigation of the nutrition-related problems of Indians, especially those of the disadvantaged sections’ (Krishnaswamy & Bamji 2014). In 1946, he applied for a government scholarship for research training in nutrition. After the interview in Delhi, he was told that he was being offered a different and better scholarship: the first Nuffield Foundation scholarship to be awarded to an Indian.

PhD and DSc, London

Gopalan landed in England amid unfamiliar sights, sounds and faces, but was welcomed very warmly and soon settled into the new life. His guide offered to enrol him for a PhD in nutrition; Gopalan pointed out that his scholarship money was only for two years, but the mentor’s response was that they would cross that bridge when they came to it. There followed two years of intense work, long hours of hands-on research, including handling of experimental animals, conducting experiments and tabulating the results. Gopalan recalled that he ‘had to do everything myself, right down to cleaning the cages. No helpers and hand-holders at all’. With a few months of extension of the scholarship period, Gopalan obtained his PhD and also a DSc within two and a half years. He returned to India, to take up a career in nutrition research.

Nutrition research in Coonoor and Hyderabad

Coonoor

In 1949 Gopalan joined the Nutrition Research Laboratories (NRL) as deputy director in Coonoor, in the Nilgiris (figure 1). NRL was founded in 1918 (coincidentally the year Gopalan was born) by Sir McCarrison and was housed in the premises of the Pasteur Institute, in an old building that had been a jam factory. Gopalan and his small but committed group of scientists initiated research studies on undernutrition and anaemia in the most vulnerable groups: children and pregnant and lactating women. Initial studies were in hospital patients, meticulously documenting clinical presentation, management and outcomes. These were followed by larger studies to confirm the findings, using well defined protocols and meticulous recording of findings. After their discharge from hospital, severely undernourished children were followed up in their homes. Thereafter, community-based studies were undertaken to assess the feasibility of prevention, early detection and management of different grades of undernutrition in children in community settings. Meticulous studies for a decade or longer led Gopalan to conclusions that contradicted the findings of earlier publications from across the globe. He had the courage of his conviction to state his findings and publish his research results.

* Numbers in this form refer to the bibliography at the end of the text.
His early research studies were on kwashiorkor and marasmus, which were the two major nutritional problems affecting children not only in India but also worldwide at the time. He made the important finding that, in chronically severely undernourished children, episodes of infection or other stress led to the development of kwashiorkor. Kwashiorkor was life-threatening and required hospitalization and intensive treatment. Gopalan showed that children discharged after treatment for these diseases could be satisfactorily managed at home by their families with the normally available foodstuffs and some instruction on what and how often to feed the child. Follow-up studies showed that simple preparations, made from a mixture of roasted and ground rice, pulses and oilseeds along with jaggery, fed to the children three or four times a day were effective in preventing recurrence of these deficiency diseases (4). Over the next two decades, these findings on effective management of protein–calorie malnutrition in children were confirmed by clinicians across India and South Asia. One of his publications in the *Indian Journal of Medical Research* (*IJMR*), titled ‘Kwashiorkor in India’ (3), was re-published as an *IJMR* classic in the 2013 centenary issue.

It had long been assumed that kwashiorkor was due solely to deficiency of protein in the diet. Based on this view, international agencies were advocating protein concentrates (such as fish protein concentrates and leaf protein powders) for developing countries as a solution to the problem. Gopalan’s studies showed that both kwashiorkor and marasmus were manifestations of protein energy malnutrition (PEM) and responded well to feeding and healthcare.

In 1992, this paper was reprinted as a ‘Medical Classic’ by the *National Medical Journal of India* (13), along with a commentary by J. C. Waterlow FRS:

The paper published nearly a quarter of a century ago and still widely quoted, had a very important influence on all of us working on childhood malnutrition. This paper of Gopalan’s had an impact in three ways: it showed the artificiality of regarding malnutrition, as it evolves in a community,
as a single-factor disease; it restored the balance when the pendulum had swung too far towards exaggerating the importance of protein; and it displayed the dangers of basing public health policy on inadequate scientific evidence.

Gopalan’s studies on the effect of food supplementation on growth in undernourished children (11) laid the foundation for the nutrition component of the Integrated Child Development Scheme (ICDS), which is currently the largest food supplementation programme for preschool children in the world.

**Hyderabad**

NRL moved to Hyderabad, Andhra Pradesh, in 1960, and Gopalan took over as its Director in the early 1960s. Over the next decade he recruited and guided young medical and non-medical scientists and set up departments of biochemistry, pathology, endocrinology and biophysics so that the institution could undertake holistic studies on major nutrition problems. Keenly aware that hospital-based studies form an important part of research into nutritional status, he obtained clinical beds for his research teams in two large government hospitals in Hyderabad, in addition to the field unit for community-based research. The Education Extension division that he set up provided a forum for dissemination of nutrition education (figure 2). The research facilities, the 24 h library and the spacious campus attracted dedicated scientists and enabled them to be productive. In 1969 NRL celebrated its Golden Jubilee and was renamed the National Institute of Nutrition (NIN).

Up to the 1950s there was very little recognition of the link between the quantity and quality of fat consumption, hypercholestrolemia and atherosclerosis. Gopalan showed striking differences in serum lipid profile with people consuming butter and hydrogenated fat, on the one hand, and sesame oil, mustard oil, groundnut oil and corn oil on the other (5, 6). This was one of the earliest demonstrations of the importance of essential fatty acids and the adverse health consequences of saturated fat and trans fats.

Gopalan and his colleagues reported high prevalence of pellagra in and around Hyderabad in populations consuming sorghum (jowar) as the staple cereal (7). The research team’s studies showed that sorghum contained low levels of tryptophan (precursor of niacin) and high levels of leucine (which inhibits absorption of nicotinic acid). They showed that leucine–isoleucine imbalance was the biochemical basis of the disease (8) and that it could be cured by correcting the imbalance or by administering nicotinic acid (9). A steep decline in pellagra in these population groups occurred over the next decade when subsidized rice was provided through the public distribution system and replaced jowar as the staple cereal.

NIN scientists also investigated the cause of lathyrism, a crippling disease among agricultural labourers in a part of neighbouring Madhya Pradesh. These labourers were given inexpensive kesari dal in lieu of daily wages, and they consumed rotis made of this dal as their staple diet. The research team identified the specific food toxin responsible for lathyrism, and this finding led to intensive advocacy to ban the cultivation of kesari dal. The ban was duly imposed, although its cultivation continued in isolated pockets. With kesari dal no longer being offered as wages, the incidence of the disease declined.

Other important contributions of NIN scientists were in mapping the changing epidemiology of fluorosis associated with changes in water table levels in India, identifying conditions that led to aflatoxin contamination of groundnut and ergot contamination of bajra,
In the 1960s the prevalences of maternal undernutrition, anaemia and low birth weight were very high in India. Gopalan pioneered studies on maternal and infant nutrition with special emphasis on the impact of maternal undernutrition and maternal iron-and-folate-deficiency anaemia on pregnancy outcome and birth weight. His studies showed that maternal food supplementation and iron and folic acid supplementation during pregnancy resulted in improvement in maternal nutritional status and birth weight of the infant. These studies laid the foundation for the ICDS food supplementation programme for pregnant women and the National Anaemia Prophylaxis Programme for pregnant women.

His studies on lactation showed that even undernourished women were able to breastfeed their infants for two years or longer; they secreted adequate quantities of milk with sufficient macronutrients to promote optimal growth, and breastfeeding protected the infants against infection. These studies provided the national database for the nutrition education and recommending suitable measures to control associated disease outbreaks. Subsequently a full-fledged food and drug toxicology division was established at NIN.
campaign in the 1970s to protect and promote breastfeeding, so that India escaped the adverse consequences of bottle-feeding in vulnerable sections of population.

At NIN, Gopalan initiated a project to compile authentic information about the nutrient compositions of common Indian foods. The subsequent publication, *Nutritive value of Indian foods* (10), listed the nutrient contents of Indian food items, with their regional names provided for easier recognition. It went on to see numerous subsequent editions and was published in many Indian languages (figure 3). Realizing the importance of this contribution and the need to update information in the light of current technology available for nutrient analysis, NIN brought out *Indian food composition tables* in 2017 (Longvah et al. 2017).
Recognizing the importance of systematic data collection on dietary intake, nutrition and health status of the population, Gopalan established the National Nutrition Monitoring Bureau (NNMB) almost at the same time as the National Sample Survey Organisation was established by the Government of India. NNMB surveys provided vital information on ongoing changes in dietary intake and nutritional status of urban, rural and tribal populations over three decades in selected states. In the past two decades, NNMB surveys have provided early warning of the sharp decrease in physical activity in urban and rural populations and the emerging problem of overnutrition and non-communicable diseases in both urban and rural areas.

Research contributions and publications from NIN were nationally and globally recognized; they laid the foundation for many national nutrition programmes, including the National Anaemia Prophylaxis Programme (iron and folic acid supplementation programme), the National Prophylaxis Programme Against Nutritional Blindness (Massive Dose Vitamin A Supplementation Programme), the ICDS and the Mid-day Meal (MDM) programmes. Some of those people who had been recruited and mentored by Gopalan followed him as director of NIN for the next three decades (1973–2003) and NIN remains the premier nutrition research institution in India. In 2018 NIN celebrated its centenary year alongside Gopalan’s centenary year.

Indian Council of Medical Research

In 1973, Gopalan moved to New Delhi as Director General of the Indian Council of Medical Research (ICMR). He invested his time and energy towards strengthening the existing ICMR network of institutions dealing with nutrition, reproduction and communicable and non-communicable diseases; he initiated building institutions devoted to research on leprosy, malaria, filariasis and kala-azar. Decades later, the World Health Organization (WHO) has focused attention on these ‘neglected tropical diseases’ as they continue to be a major cause of morbidity in many developing countries. Indian scientists working in ICMR research institutes have played, and continue to play, a major role in shaping global and Indian programmes for control of communicable and non-communicable diseases and combating malnutrition.

In order to ensure that ICMR institutions have a steady pool of talented and dedicated research personnel to draw from, Gopalan established the Talent Search Scheme (TSS). Under this scheme, medical graduates across India were chosen on the basis of merit, supported by ICMR during their postgraduate training and posted in ICMR institutes of their choice. The next three decades showed that, wherever they worked, TSS doctors contributed substantially to medical research. Some continued in ICMR research institutions and eventually became directors, with Dr V. M. Katoch rising to the position of Director General, ICMR.

As the first chairman of the Regional Advisory Committee on Medical Research for South East Asia (WHO, SEARO), Gopalan advocated stepping up research on the shared health problems of South Asian countries and promoted the building of a grid of medical research institutions in these countries.

Nutrition Foundation of India

After he retired as Director General of ICMR, Gopalan set up the Nutrition Foundation of India (NFI) in 1980 as a non-governmental organization in New Delhi devoted to improving
the nutritional wellbeing of Indians. Three decades later he recalled (15):

I had dreamed of building an institution for nutrition research in India from scratch, from the ground up, as a non-governmental organisation. When I retired as Director-General of the ICMR thirty years ago, I decided to try to make a dream come true. I faced great challenges in building and nurturing the Nutrition Foundation of India (NFI) and I worked at least as hard as any youngster starting out in his working life; during the initial phases, my garage at home was my office. Fortunately, many well-wishers shared my vision, and NFI is now a well established nutrition research centre.

His first ‘office’ was his garage at home, with one assistant, a steno-typist; NFI moved later to rented premises before finally settling, in the middle 1990s, in its beautiful new building on land allotted to it by the government of India in recognition of his services (figure 4).

His reputation and his networking over the years held him in good stead in realizing his dream. Staff members were recruited, and budding researchers signed on. Over the next four decades he drew attention to problems in implementation of the ongoing nutrition programmes, and suggested mid-course corrections. He ensured that NFI carried out operational research studies at urban primary health centres and in urban low-income communities, and provided leads for improving implementation of the nutrition intervention programmes.

Exploring ongoing nutrition and health transition in India was another area that received major attention. NFI brought out a series of scientific reports detailing its research studies and findings. Gopalan himself has written more than 100 articles and reviews in the NFI Bulletin on varied aspects of public health nutrition, covering the broad areas of policy and programme implementation, the agriculture–economics–nutrition inter-linkages, childhood malnutrition and stunting, pregnancy and lactation, data interpretation and analysis, micronutrient deficiencies, nutritional transition, the emerging problem of obesity and the triple burden of malnutrition that India is currently facing.

**Gopalan’s philosophy of nutrition research**

*‘Farms, not pharmacies’*

Gopalan firmly believed that, for India’s type and scale of nutritional problems, farms hold the solution, not pharmacies. That is, solutions have to be food-based if they are to be sustainable, and resorting to artificial supplements should be avoided except in emergency-type situations and in special needs such as pregnancy. He steadfastly championed food-based interventions even when artificial chemical supplements appeared more attractive as a short-term fix, because his decades of experience had shown him that short-term fixes do not work in the long term. This was a kind of mantra to him, and a theme that he stressed continually. Traditional diets in all parts of the country were sufficiently varied and balanced, and it was important to explain to the people that the key to good nutritional status was available in their own kitchen gardens. His initiative with the publication *Nutritive value of Indian foods* (10) was an early example of his emphasis on the food-based approach. Throughout the six decades of his engagement with nutrition research in India, he never hesitated to advocate the food-based approach.
In India, with a large vegetarian population, cereals are the major source of energy and pulses and legumes are the major source of proteins. The Green Revolution of the 1960s and 1970s introduced high-yielding varieties of rice and wheat and made India self-sufficient in cereal production, but, as Gopalan pointed out, the cultivation of legumes and pulses had suffered as a result of the focus on cereals. He advocated stepping up the production of pulses to ensure optimal cereal–pulse intake in Indian diets.

The eminent agriculture scientist Monkombu Swaminathan (FRS 1973), Magsaysay Prize and World Food Prize awardee, has always been keenly aware of the synergies between food and nutrition sciences, and shares Gopalan’s holistic view of these inter-related disciplines. Both scientists were on the Indian prime minister’s expert committee, the National Nutrition
Mission, set up in 2003, and both referenced each other’s work on many occasions. When Gopalan passed away in 2019, Dr Swaminathan instituted an annual lecture at M. S. Swaminathan Research Foundation to honour his fellow scientist. The first lecture was delivered by Dr Soumya Swaminathan, currently chief scientist at WHO, Geneva. In his opening remarks on the occasion of this first lecture, Dr Swaminathan said

Dr Gopalan played a significant role in linking agriculture, nutrition and health. Thus he was ahead of his time in dealing with public health issues. His contributions to the building of the National Institute of Nutrition and laying the foundation for a nutrition-secure India are truly monumental. He has helped to shape the approach to nutrition security not only in our country, but other countries of Asia. A man of great vision and a practical person.

‘Follow the evidence’

Gopalan believed in expressing opinions based on scientific evidence, even if it ran counter to current beliefs or opinions. His attempts to highlight nutrition problems in the country were at times unpalatable to those in positions of authority. As he recalled (15):

It was an important occasion. I was delivering the Jawaharlal Nehru Memorial Lecture. Seated on the dais, among others, was Nehru’s daughter Indira Gandhi. In the course of my speech, I pointed out that malnutrition and hunger were still problems for children in India, and made an impassioned plea for Mahatma Gandhi’s and Nehru’s visions for healthy Indian children to be made a reality. When Indira Gandhi got up to speak, she showed her annoyance in no small measure. She wondered why we scientists had to paint such a gloomy picture of the situation. Turning to me, she said, “Everywhere I go, I see only healthy, happy, smiling children. I don’t see this malnutrition you speak about”. I suppose I looked suitably abashed. Being a politician and a national leader, she would see only what was shown to her on her travels! However, after she was returned to office, she was always supportive of scientific research in nutrition and willing to consider proposals that were brought to her attention.

Salt iodization had proven feasible as an intervention for control of iodine deficiency disorders (IDD). Even though India initiated the goitre control programme in 1962, the quality of the salt provided and coverage under the programme were poor. In 1981 Gopalan wrote a review in the NFI Bulletin titled ‘The National Goitre Control Programme: a sad story’ (12). He pointed out that, two decades after initiation of the goitre control programme in India, there were still major bottlenecks in every aspect of implementation: production, transport and distribution of the iodized salt, and effective education of the population to promote acceptance. He pleaded for universal iodization of salt and effective implementation of the programme. There were attempts to introduce iodized oil injections for pregnant women as a measure to prevent iodine deficiency-related cretinism in newborn babies. Gopalan opposed these interventions because they would distract the focus from the universal salt iodization programme, which was the only sustainable solution in the long term. In the 1990s the IDD programme was revamped with the goal of providing universal access to iodized salt across the country. Iodization of salt was made mandatory in 2007, and within a decade India has achieved near-universal access to iodized salt.

When circumstances changed or new evidence emerged, Gopalan had no hesitation in following the evidence and recommending the scrapping of a programme he himself had once championed. For instance, in the 1960s keratomalacia due to vitamin A deficiency was a major problem, associated with very high mortality rates; many of the survivors suffered from
corneal blindness and died subsequently. Gopalan showed the link between undernutrition, vitamin A deficiency and infections (especially respiratory infections and measles), on the one hand, and keratomalacia, on the other. Clinical and laboratory research studies and a community-based, five-year follow-up study carried out at NIN established the safety and efficacy of administering massive doses of vitamin A to children under five years of age for the prevention of keratomalacia. Based on these findings, the National Programme for Prevention of Blindness, popularly known as the Massive Dose Vitamin A Supplementation Programme, was initiated in the 1970s. Several developing countries also initiated similar programmes.

Two decades later, surveys clearly showed that, although the coverage of massive dose vitamin A supplementation was low and patchy in India, keratomalacia had become a rarity. This might have been due to reduction in severe undernutrition, better access to healthcare and measles immunization. Over the next decade, Gopalan published numerous reviews recommending stopping the programme, citing the fact that blindness due to vitamin A deficiency was no longer being seen, and quoting global reports of adverse health consequences of using massive dose vitamin A supplementation. Gopalan, who had contributed immensely to the initiation of the national Massive Dose Vitamin A Supplementation Programme, set an example to others by becoming an ardent advocate for terminating the programme when keratomalacia became rare. The programme is being reviewed in the light of these findings and is likely to be replaced by more targeted interventions.

Similarly, when new evidence pointed to emerging nutrition problems, Gopalan was quick to flag it. For example, having spent over three decades in combating undernutrition and its health consequences, he was one of the first to recognize that India is undergoing a nutrition transition. Studies carried out under his leadership at NFI and his reviews in the NFI Bulletin showed that, while undernutrition remained a major problem, overnutrition was emerging as a major public health concern, not only among the well to do but across all sections of the population. NFI study reports and reviews on the dual nutrition burden were published in peer-reviewed journals as well as in international reports. His efforts turned the spotlight on the emerging nutrition problem in India and its potential to exacerbate the burden of non-communicable diseases, and led to the initiation of integrated disease surveillance programmes for detection and management of under- and overnutrition and non-communicable diseases through the primary healthcare system in India.

**The role of ‘unforeseen factors’**

Gopalan delivered the J. C. Bose lecture under the auspices of the Royal College in London on 5 November 1998; in his presentation he highlighted the role of unforeseen factors in the epidemiology of diseases. He pointed out that the decline in the incidence of lathyrism and pellagra in India were due not entirely to nutritional interventions but in good measure to changes in consumption patterns brought about by economic factors.

On the eve of entering the new millennium, Gopalan wrote an article in *Current Science*, titled ‘The changing epidemiology of malnutrition in a developing society: the effect of unforeseen factors’ (14). He ended the article by stating:

> Diseases apparently have natural histories of their own. Like empires and civilisations they rise, reign for some time, and then fall or change their course. Scientists can often take credit for the decline of several diseases such as, say, smallpox. In some cases, however, the disappearance or
changing course of once-rampant diseases cannot be directly attributed to scientific intervention. Pellagra and lathyrism had disappeared not so much because of solutions offered by scientists but because of unforeseen factors unleashed by the developmental process. Diseases such as goitre and fluorosis have changed their epidemiology as a fall-out of developmental programmes. As we move into the next millennium new discoveries and technologies are bound to find application as part of ongoing ‘development’. Some of these may have unforeseen effects, sometimes beneficial and sometimes not. Scientists are not always the masters of human destiny or of the environment. This must be a sobering thought. We must be vigilant in monitoring new interventions in a fast-changing world, and their effects on the health status of populations and on the course of diseases.

INSTITUTION BUILDER, MENTOR, NETWORKER

Individual scientists contribute their knowledge and expertise during their lifetime, but institution builders build institutions and the careers of generations of individuals, establish a valuable talent pool that is inexhaustible and will serve the country now and in the future. Good institution builders are those who are always alive to opportunities, not only to enhance existing strengths, but also to incubate novel ideas and venture into hitherto untrodden paths. Gopalan understood this and put a lot of his energy into building institutions (NRL, NIN and NFI) and mentoring scientists across India and Southeast Asia to meet the challenges of the ever-changing nutrition scenario in the country and the world (figure 5).

He looked upon every institution, project and process as an ongoing one, to be continuously improved. Simultaneously, he was always looking to lay the groundwork for new ventures and initiatives that would have a synergistic and multiplier effect. Besides building up the fledgling NRL into the world-renowned NIN and laying a firm foundation for its continued growth and development, and then moving on to strengthening and further enhancing the ICMR network of institutions, he was a visionary who planned for the future. His initiative, as director of NIN, to train and build a pool of young nutrition scientists in the Southeast Asian region, as well as his novel initiative as Director General of ICMR to set up the TSS to spot research talent among the newly minted medical graduates throughout the country, proved to have benefits that reached decades into the future.

He was skilled at recognizing talent in people. In a tribute, Kamala Krishnaswamy, former Director of NIN, wrote (Krishnaswamy & Bamji 2014):

Personally, I am greatly indebted to Dr Gopalan who shaped my career and guided me through my sojourn in the field of nutrition. I knew nothing about nutrition or research, but his intuition that I would be suitable for the organization, filled me with courage and confidence. The younger generation looked up to him and he in turn motivated, energized and enabled all of us to work hard and be productive.

Gopalan’s many students and colleagues remember him as being an inspiring and motivational mentor and role model. Mahtab S. Bamji (NIN) remembers (Krishnaswamy & Bamji 2014):

We who worked at NIN have experienced at first hand the unique scientific culture that Dr Gopalan helped to nurture at NIN during those years. Apart from research activities, weekly group meetings, seminars and journal club meetings were held to discuss the most recent advances in nutrition and the work done at NIN. He had a unique way of guiding research by asking questions. This forced us to think and plan. Unlike many senior scientists, he never allowed his name to be put on a paper in which he felt his contribution through ideas or guidance was not
sufficient to merit it. Thus, I regret not having him as a co-author on any of my publications, despite having benefited immensely by picking his brain.

He was known for his wide-ranging expertise and his colleagues appreciated his approach to his work. Dr S. N. Jagannathan, emeritus professor of pathology, West Virginia University School of Medicine, remembers:

In the formative years of my career I attempted to take Dr Gopalan as my role model, particularly as regards the scientific way in which he approached any research problem, not to mention the way he organised his talks and writings on any subject. I believe my academic career in the US benefited from this, and helped me in my scientific associations with stalwarts in atherosclerosis research.

Gopalan’s son, Dr Sarath Gopalan, recalls:

My father was very, very particular about preparing perfectly for every important speech or lecture. He would organise his speech and rehearse it often in the days leading up to the event. He saw it as his duty to convey his ideas as clearly and precisely as possible. This was his practice right through all the decades of his career. The Asian Congress of Nutrition was due to be held in February 2003 at Delhi, and my father had a key role in organising it. In late 2002 my father took seriously ill and had to spend several weeks in hospital. Colleagues stepped in to help as he monitored every detail from his hospital bed. One day, as I sat by his bedside, he started to
Coluthur Gopalan

rehearse the speech he had prepared for the Congress, propped up in bed. Still far from totally well, he was present and active on all three days of the event and delivered a sparkling speech that won much appreciation.

Gopalan recognized the importance of networking among nutrition scientists. He initiated a WHO-supported MSc and certificate courses in nutrition at NIN for both Indian and South-east Asian students. He established the Nutrition Society of India and the Federation of Asian Nutrition Societies as fora for discussion on nutrition problems in India and Asia. Gopalan was involved with launching the Nutrition Society in India in the 1960s. As he recalled (15):

I had some support for the idea but there was a great deal of scepticism too. ‘There are already societies that nutritionists can join. Why do we need yet another society? You will never build up a membership. The whole thing will just fizzle out,’ they said. We went ahead with the idea. Today the Nutrition Society of India is 42 years old and has over 1000 members. It is growing from strength to strength.

Both these societies have grown over the last five decades and are now major professional associations providing useful inputs to national and international agencies pertaining to the management of the emerging problem of the triple burden of malnutrition. Gopalan organized the First Asian Congress of Nutrition in Hyderabad in 1970 and the Ninth Asian Congress of Nutrition in New Delhi in 2002 (figure 6).

Gopalan was the first scientist outside of Europe or North America to be elected president of the International Union of Nutrition Sciences (IUNS). He played a prominent role on WHO Expert panels for several years, and was the chairman of the Technical Session of the World Health Assembly in the late 1970s. Gopalan’s keynote lectures at the International Congresses
Biographical Memoirs of Nutrition at Brighton and at Seoul underscored the importance of nutrition as a major factor in national and human development. He was invited by several countries to visit their health facilities, attend meetings and deliver lectures. He recalled (15):

I have had the very great pleasure and privilege of visiting virtually every part of the world, either to give orations, chair seminars and meet with other nutrition scientists, or to spend time studying the specific malnutrition problems of those countries. I met with government leaders, the cream of the scientific community, and the common people. It has been continuing education of the richest kind. In turn, I have been able to invite some my peers to India to participate in conferences or seminars and visit our research facilities. In the course of my travels, I met many, many fascinating people and made firm friends.

Gopalan’s personal life

Gopalan lived and breathed nutrition. Though he was always happy to welcome extended family to his home, and enjoyed music, cricket and political news, these interests were always very peripheral to his focus on nutrition. His family cannot remember any occasion when they took a proper ‘vacation’ together. His wife Seetha and the children would spend summer vacations at the homes of the grandparents in Madras and Madurai while Gopalan continued at work, never missing a single day.

He and Seetha were married for 72 years; Seetha passed away at the age of 90. Their eldest son died of hepatitis in 1963 at the age of 19, while still a student in medical college. This was a shattering blow and a deeply sorrowful event in their lives. Their daughter, Malini, married and settled in Madras and took up freelance writing. Their younger son, Sarath, went on to become a consultant paediatric gastroenterologist in New Delhi. Gopalan and Seetha lived to enjoy watching their grandchildren growing up healthy and successful in their chosen fields.

After his (reluctant) retirement from a daily schedule at NFI at the age of 90, Gopalan moved from Delhi to Chennai to his daughter’s home. He continued to keep abreast of happenings in the world of nutrition, contribute review articles and steer research initiatives at NFI.

The centenary issue of Indian Journal of Medical Research carried two of Gopalan’s articles in 2013: one was a IJMR classic, ‘Kwashiorkor in India’, published in 1955 (3), and the second was a review on ‘The changing nutritional scenario in India’ (16).

Awards and recognition

Gopalan was an excellent clinician, research scholar and mentor of research scientists. These qualities gained him national and international recognition. He was elected as a fellow of all three Indian science academies. The National Academy of Medical Sciences gave him the Life Time Achievement Award in 2006; the International Union of Nutrition Sciences awarded him the Living Legend Award in 2013; and the Federation of Asian Nutrition Societies awarded him the Living Legend Award in 2019. The Government of India recognized his contributions by awarding him Padma Shri and Padma Bhushan. In 2008, when Gopalan turned 90, a festschrift was brought out in which his colleagues and those whom he had mentored shared their experiences and highlighted some of his achievements. In 2014, Current Science published an article titled ‘Coluthur Gopalan: a legend in nutrition science’, which
reviewed Gopalan’s life’s journey, his major research contributions and the recognitions that he had received (Krishnaswamy & Bamji 2014). On 16 October 2019 ICMR honoured him posthumously with the Centenary Award.

Over a span of six decades Gopalan built up institutions and human resources for nutrition research, contributed to the recognition that optimal nutrition is a prerequisite for health and human development, and enabled India to be the global pioneer in initiating intervention programmes to improve the nutritional status of its citizens. He was recognized as the Father of Nutrition Science in India. He left behind a large community of nutrition scientists and stakeholders from nutrition-related sectors as the inheritors of his legacy, who are committed and equipped to work towards realizing Gopalan’s vision of achieving nutritional wellbeing of all Indians as rapidly as possible.

Some important positions held

| Year       | Position                                      |
|------------|-----------------------------------------------|
| 1963–1973  | Director, National Institute of Nutrition     |
| 1973–1979  | Director-general ICMR                         |
| 1975–1979  | President, International Union of Nutritional Sciences |
| 1977–1980  | Member, Global Advisory Committee on Medical Research, WHO |
| 1980–2019  | President, Nutrition Foundation of India       |

Selected awards and recognitions

| Year       | Award                                                                 |
|------------|----------------------------------------------------------------------|
| 1960       | Basanti Devi Amir Chand Prize (Senior) of the Indian Council of Medical Research, for research in nutrition and public health problems |
| 1970       | Padma Shri, Government of India                                      |
| 1974       | Bidhan Chandra Roy National Award                                    |
| 1978       | Dhanvantari Award                                                    |
| 1988       | Sir C. V. Raman Gold Medal of the Indian National Science Academy    |
| 1989       | International Union of Nutrition Sciences Award                      |
| 1990       | R. D. Birla Award for outstanding medical research                   |
| 1998       | Ambuj Nath Bose Prize of the Royal College of Physicians, London     |
| 2003       | Padma Bhushan, Government of India                                   |
| 2006       | Lifetime Achievement Award from National Academy of Medical Sciences |
| 2010       | First honorary life member of the World Public Health Nutrition Association |
| 2013       | Living Legend Award of IUNS                                           |
| 2019       | Living Legend Award of FANS                                           |
| 2019       | ICMR–NIN Centenary Award                                              |

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The frontispiece portrait photograph was provided to the Royal Society by the subject—copyright is unknown. All other photographs are from the Gopalan family collection.

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