Anil Ramanbhai Sheth (1933–1994)

An obituary by T. C. Anand Kumar

India has lost one of its most prolific writers of scientific papers in the field of Reproductive Biology with the passing away of Dr Anil Ramanbhai Sheth on 13 March 1994. When I met him last during the early part of this year he told me that he had over 450 publications and was averaging about one paper every week.

Sheth was deeply interested in the study of several aspects of reproduction and most often his approaches were unorthodox and unconventional. His findings were not readily accepted but the several publications brought out by Sheth through his persistent and tenacious efforts often left his detractors with much food for thought. Some of his novel findings were the presence of extremely high amounts of prolactin in semen, autosuppression of the secretion of hypophyseal follicular stimulating hormone (FSH), the presence of FSH and LH in the prostate – an ectopic site which was not known until Sheth announced his findings of their presence and having a possible role in the autocrine and paracrine regulation of prostatic function and the presence of protein hormone receptors in the cytosolic fractions in contrast to the conventional concept of these being present only in the plasma membrane. His major contribution however, was in the field of inhibin research.

For over five decades, inhibin remained a hypothetical, water soluble protein secreted into the blood by the testis and having an inhibitory effect on the secretion of FSH. There was worldwide interest to isolate and characterize inhibin because of its potential application as a male contraceptive. Sheth along with his colleagues in India, Stockholm and Canada, was the first to report in the eighties the biochemical structure of inhibin isolated from human semen. Its origin was traced to the prostate and was found to be similar to a sperm-coating protein reported by the Japanese later. Prostatic inhibin was reported to be ubiquitous in its distribution as evidenced from the plethora of papers that emanated from Sheth's laboratories. Its function was also diverse. It became obvious that inhibin isolated by Sheth had more than one function. A few years later, Roger Guilleman and his group isolated and described the structure of another inhibin from the testis which was a heterodimer and totally different from the structure described by Sheth. This heterodimer also has diverse functions besides inhibiting pituitary FSH and is also found to be present in regions other than the testis. The question now arose, particularly in my mind as I was then heading the institution where Sheth was carrying out his studies, as to which was the true inhibin? The one isolated earlier by Sheth from human semen? or the one isolated later by Guilleman from

the testis? I posed this question to Sheth; he was firm that his was the true inhibin because it exhibited all the properties attributed to the postulated protein in the thirties. The only argument against this was that the protein could not qualify to be inhibin because of its extratesticular origin. But then Guilleman's inhibin was also not restricted to the testis although it was initially isolated from this tissue. In most of the scientific literature inhibin refers to the heterodimer isolated from the testis. Is this an instance of the West's reluctantance to accept Indian discoveries in face of formidable experimental evidence?

Besides such esoteric considerations one cannot remain unimpressed by the vast range of endocrine, paracrine and autocrine activities attributed to the prostatic inhibin by Sheth and his colleagues as well as for the testicular inhibin. It can truly be said that the search for inhibin has opened out new vistas on how one looks at protein-regulators of the various physiological functions of the body.

Be that as it may, neither the prostatic nor the testicular inhibin has yet found any practical use in the field of contraception which was the motivating force to isolate and characterize this protein. Prostatic inhibin was described by Sheth and co-workers as an useful immunodiagnostic tool for the early detection of prostatic cancer – a field which Sheth was actively pursuing till his last days.

The other major task undertaken by Sheth was to isolate and characterize pituitary hormones for a National Pituitary Agency set up by the Indian Council of Medical Research. This was undertaken to make available reagents for the assaying of human reproductive hormones both for diagnosing reproductive disorders as well as evaluating new contraceptives being tested in India. It was also hoped that the National Pituitary Agency would make India self-sufficient in the production of Growth Hormone for Replacement Hormone Therapy for dwarf children. The global concern of Cruetzfeld disease being associated with human tissue as well as the possible viral contamination (including HIV) of pituitary glands collected from unclaimed dead bodies in mortuaries resulted in the abandoning of this programme despite Sheth and his colleagues having successfully purified human growth hormone.

Anil Ramanbhai Sheth or Anil Bhai as he was known to his close associates was a person with unassuming mien and very polite. But there was a streak of stubbornness under this seemingly noncontroversial person. He never allowed others' skepticism undermine his conviction.

Sheth was a Bombayite and a source of considerable information on the history of Bombay and its environs. I

have spent several moments learning about the good old days of this city. He lived in Chowpatti, studied in the adjoining Wilson College, did his PhD in the Cancer Research Institute under the late Dr Khanolkar and worked with the late Dr Shanta Rao and continued to be associated with her even after she moved on to the Institute for Research in Reproduction where he continued until his last days. He married his childhood friend, Nandini, when she was his colleague at the Cancer Research Institute, brought up his only daughter, Bella, who is now a practising gynaecologist in Bombay. He was close to his family as he was with his large number of students – he produced 23 PhDs who are distributed throughout the country and abroad. I am sure the seeds sown by Sheth will reach fruition one of these days through the vast number of students he has left behind.

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Subramanyan Suryanarayanan (1927–1994)

An obituary by T. S. Sadasivan

Subramanyan Suryanarayanan was born in Kadattur, Tamil Nadu on 23 January 1927. His schooling was in the Nanjappa High School, Tirupur and he completed his Intermediate in 1944 with a first class in Natural Sciences, Physics and Chemistry from the Government Arts College, Coimbatore. In 1947 he took a BSc (Agric.) from the Agricultural College, Coimbatore and was awarded the De Silva Medal. After a spot of work in the districts as Agronomy Assistant he took up a research fellowship to work in the University Botany Laboratory under the supervision of T. S. Sadasivan and was awarded a PhD in 1956 in Plant Pathology for his thesis on the blast disease of rice. In 1964 he joined the research staff of the Centre for Advanced Studies in Botany at Madras, first as Lecturer, was later promoted to a Readership in 1968 and finally elevated to a Chair in 1984. Suryanarayanan was on the Editorial Board of the *Journal of Scientific & Industrial Research*, Member of the Indian Botanical Society, Indian Phytopathological Society, the Philippine Phytopathological Society and the Society of Biological Chemists (India). He was elected Fellow of the Indian Academy of Sciences in 1971.

For all his researches, Suryanarayanan used a model system – the 'rice blast' disease by the air-borne pathogen *Pyricularia oryzae* on its host *Oryza sativa*. Besides establishing the total and absolute vitamin heterotrophy of *Pyricularia* spp. to thiamine and biotin, the essentiality of Fe and Zn to *Pyricularia* growth *in vitro* was shown by his investigations. Suryanarayanan also worked on aspects of essentiality of Fe and Zn in the growth of the fungus *in vitro*. Another aspect of the heavy metal nutrition of this fungus was the demonstration of Fe–Cu antagonism. Suryanarayanan's major effort in the eighties was in the study of toxins elaborated by *Pyricularia* spp. which showed that except for Pyriculol, other reported toxins were not produced by Indian isolates of the fungus. Indeed, mutation and serological techniques were used to understand host/pathogen interactions in the rice blast system. Blast fungi were shown to possess, not

only O-diphenol oxidase, but also laccase. The toxin Pyriculol was shown to be present *in vivo* in one of the blast diseased graminaceous hosts (*Brachiaria mutica*). In fact, a neutral toxic fraction was identified in blast diseased leaves of rice, which was found to exert a greater toxic effect on a resistant than a susceptible cultivar. What was interesting about this toxic principle was that it could be counteracted with benzimidazole.

One of the significant contributions made in the fifties was the role of genotype–nyctotemperature interactions in the rice-blast syndrome. Low night temperatures were shown to be critical not only in host compatibility but also host range. Host-induced variability of the fungus was also demonstrated. Suryanarayanan's work at the International Rice Institute in the Philippines indicated that wettability of rice leaf surface is an important component of 'stable' (horizontal) resistance of rice blast and that this component is heritable, thus suggesting that evolution of rice varieties with highly hydrophilic leaf surfaces could considerably mitigate the incidence of the blast disease.

Suryanarayanan broke new ground when he showed that rapid lignification during early stages of infection in blast-resistant rice varieties was accompanied by increased levels of PAL (phenylalanine ammonia lyase) and peroxidases. In fact, host specificity of *Pyricularia* seemed to have involvement of both pre- and post-inoculation fungal components and it also became apparent that host–parasite relationship at the leaf surface, especially in the epicuticular wax layer, appeared significant.

Suryanarayanan and his collaborators worked on alterations in rice leaf tissue permeability which was brought about not only by toxins of *P. oryzae* but also by a $FeCl_4^+$ toxic host component. Furthermore, the toxins of *Pyricularia* were demonstrated by his group to induce 'green islands' in rice leaf tissue.