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OBITUARY

Vidyadhar Govind (Pandit) Tatake (1926–2004): An ingenious instrumentalist, an authority on thermoluminescence, and a lover of classical Indian music

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A very close personal friend and associate Vidyadhar Govind (Pandit) Tatake passed away on September 30, 2004 after a prolonged illness, at Pune, India. His family was with him when he breathed his last. Born on July 24, 1926 in a farmer's family to Indira and Govind Tatake at Sangli, Maharashtra, India, Pandit had his early education at the prestigious Nutan Marathi Vidyalay in Pune. Graduating from the school he joined the equally illustrious Fergusson College, Pune University, from where he obtained his M. Sc. in Physics in 1953.

He was a voracious reader and impressed everyone even in his childhood by his knowledge of several areas including traditional Hindu teaching and philosophy. It was for this reason that he was nicknamed Pandit meaning a learned person. This name stayed with him all his life and his friends always called him by this name. Although he was interested in Physics in general, he had a special liking for electronics and instrumentation. When he studied Physics, electronics was still nascent and hence found only a perfunctory place in the curriculum. So he decided to obtain a post-graduate diploma in Electronics right after his M. Sc. in Physics from University of Pune. At that time there were very few who had specialized training in both of these important disciplines. It was also the time Independent India was anxious to set up world-class institutions for research in leading branches of science. One such area was that of Atomic Energy. The Father of Indian Atomic Energy Establishment, Dr. Homi Bhabha, with the blessings from the then Prime Minister Jawaharlal Nehru, was enlisting intellectuals to undertake research and development in all the areas of Atomic Energy including biological effects and applications of Atomic Energy. A major department of Biology and Agriculture was established, in 1952, in the Atomic Research Establishment. Initially it was located in the premises of the Indian Cancer Research Institute at Parel, Mumbai (then called Bombay), but soon thereafter shifted to the Richardson and Cruddas

Vidyadhar Govind (Pandit) Tatake (1926–2004)

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Building in Mumbai. Among many others, Pandit Tatake was also selected to work in this prestigious institution in 1953. He initiated studies on effects of non-ionizing radiations on biological materials; it was published in 1961 *Nature* (Ranade et al. 1961).

After being trained in Radiobiology at a workshop organized by the International Atomic Energy Agency at the Weizmann Institute in Rehovoth, Israel, he proceeded to London, UK, for his Ph.D. and carried out studies under the guidance of Professor Joseph Rotblat (1908–2005), who was at that time actively engaged in elucidating the role of radiation induced free radicals in biological materials. He looked at these very active species with the help of ESR spectroscopy. He returned to India after his Ph.D. degree, in Biophysics, from London University in 1965. Rotblat was later (1995) to receive the Nobel Peace prize for his role in the Pugwash movement along with Pugwash Conferences on Science and World Affairs for ''their efforts to diminish the part played by nuclear arms in international politics and, in the longer run, to eliminate such arms''. (We note that Eugene Rabinowitch (1898–1973) had also played a crucial role in the Pugwash Conferences: see Joseph Rotblat's tribute to Eugene Rabinowitch at: http://www.pugwash.org/reports/pac/pac256/rotblat.htm.)

Tatake's studies in London further enhanced his innate love of various spectroscopic techniques. He employed these to learn more and in detail about effects of ionizing and non-ionizing radiations on biological materials. Together with Dr. A. R. Gopal-Ayengar, a pioneer in biological sciences in India at that time, Tatake used microspectrophotometry to identify different pigments of the green alga *Chlorella* (Thomas et al. 1970a) and multiple forms of chlorophyll *a* in the green algae *Chlamydomonas reinhardtii* and *Scenedesmus obliquus* (Thomas et al. 1970b). These were important papers since C. Stacy French, at the Carnegie Institution of Washington at Stanford, was investigating these multiple spectral forms of chlorophyll *a* mainly in suspensions of algae (see e.g., French 1971; Govindjee and Fork 2006).

Tatake belonged to the old school of experimentalists who enjoyed designing and building novel instruments tailor-made for their studies. In 1971, he designed a variable temperature cryostat for the measurement of thermoluminescence (TL) (Tatake et al. 1971). This set-up was the one that the Bhabha Atomic Research Centre (BARC, at Trombay, Mumbai) used for their TL studies on photosynthetic membranes. Later a research group in Szeged, Hungary (see Demeter et al. 1979) set up its TL instrument based on Tatake's design. It provided accurate information on the temperature of the glow peaks (T_m's); this was achieved because the thermocouple was located very close to the sample. (With the guidance and help of Tatake, a similar set-up for measuring TL was later established in the research group of Pandit Vidyasagar, in the Department of Physics, at the Pune University.)

Around 1972, Pandit Tatake was joined by one of the authors (PVS) who had just returned from the USA after his studies on 'Chloroplast Structure and Function' at the University of California at Berkeley. It was then that the group at BARC began their studies in the area of thermoluminescence in photosynthetic organisms and demonstrated six well-resolved glow peaks from a leaf (Sane et al. 1974). Based on their observations on nucleic acids that one of the components of the light emitted during TL occurs invariably as a result of triplet to ground transitions, they proposed that the luminescence observed in isolated chlorophylls as TL originated in the triplets of chlorophylls (Sane et al. 1974). Tatake, in collaboration with his colleagues Sane and T.S. Desai, studied TL characteristics of different organisms and identified the reducing and oxidizing species involved in the recombination processes (Desai et al. 1975, 1977; Sane et al. 1977). An important contribution from Tatake's group related to the demonstration that the appearance of a TL band appearing around 0 C (the Q band) was associated with the oxidation of reduced Q_A, providing one of the earliest proofs for participation of reducing equivalents by the quinone acceptors of Photosystem II (PS II) in the TL emission from photosynthetic membranes (Desai et al. 1975).

Another important contribution by Tatake was the study of energy storage states in the photosynthetic membranes. Tatake et al. (1981) showed that Randall and Wilkins theory, that was used earlier by William Arnold, the discoverer of TL in photosynthetic organisms (see Arnold and Sherwood 1957) to determine various biophysical parameters of the glow peaks yielded unusually high values of activation energies and frequency factors in general and for the high temperature peaks in particular. Tatake et al. (1981) favored the calculation of activation energies using the initial rise method rather than assuming any constants and observed that this approach provided much better estimation of activation energies. These studies attracted the attention of Govindjee, who was a coauthor of this paper. In collaboration with Don DeVault and Arnold, he extended these studies further using the glow curve data from Tatake's group. Thus, DeVault et al. (1983) and DeVault and Govindjee (1990) were able to provide the first comprehensive theory on the mechanism of TL in plants.

Light emission from photosynthetic membranes interested Pandit Tatake and it was shown that PS I emits light at high temperatures (Sane et al. 1980); also, he characterized the high temperature glow curve peaks of photosynthetic material. An important observation made by his group relates to the identity of delayed light emission and the glow peaks: Desai et al. (1982) demonstrated that for each glow peak there is a component of delayed light emission and the two are identical to each other. In a series of papers published in Journals in India (Sane et al. 1983a, b, 1984), the role of reducing entities and the oxidizing entities (the S states) were validated. [For contributions of other research groups on this topic, see mini-reviews by Vass and Govindjee (1996) and Vass (2003).]

Pandit Tatake took early retirement, in 1983, and served as an advisor to the Maharashtra Energy Development Agency, Mumbai; here, he devoted his time to the development of non-conventional energy sources, particularly solar energy. Besides his love for science, Pandit listened to classical and light Indian music. His father-in-law Gajanan Joshi was a well-known and a highly-respected singer of the light music, and several musicians used to visit their home and perform at his house. For some of us, this provided an opportunity to listen in person to various revered Indian singers. Pandit was an excellent teacher and taught biophysics and instrumentation to several including us. He was frank and blunt in his opinion, and we have on several occasions benefited from his advice.

Tatake is survived by his wife, Ragini, two sons Abhijit, Ashutosh and a daughter Aditi and four grand daughters, Renuka, Radhika, Neeraja, and Shruti.

This tribute was invited and edited by Govindjee, who is a great admirer of Pandit Tatake, and has fond memories of working with Tatake at the BARC laboratory during his sabbatical in 1977.

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