

1. Tandon, S. N., *The Tribune*, 14 August 2017; <http://www.tribuneindia.com/news/comment/scientist-leader-institution-builder/445493.html>
2. *Yash Pal – Eighty Years Young*, Festschrift with 31 contributions and a selection of Professor Yash Pal's non-technical writings, with a preface by A. P. Deshpande, National Centre for Science Communicators, Vidnyan Bhavan, Mumbai, India, 2006.
3. Biman Basu, *Yash Pal: A Life in Science*, Vigyan Prasar, Noida, 2006.
4. Jayan, T. V., *Frontline*, 2 August 2017; <http://www.frontline.in/other/obituary/for-the-love-of-science/article9796443.ece>
5. Cowsik, R., *Curr. Sci.*, 2015, **109**, 202–208.
6. Narayana Murthy, N. R., in ref. 2, p. 26.
7. Lal, D., Yash Pal and Peters, B., *Phys. Rev.*, 1953, **92**, 438–440.
8. Hale and Dottie Bradt, Greetings to Yash Pal, in ref. 2, p. 57 and private communication.
9. Bridge, H. S., Caldwell, D. O., Pal, Y. and Rossi, B., *Phys. Rev.*, 1956, **102**, 930–931.
10. Boldt, E., Bridge, H. S., Caldwell, D. O. and Pal, Y., *Phys. Rev.*, 1958, **112**, 1746–1749.
11. Boldt, E., Caldwell, D. O. and Pal, Y., *Phys. Rev. Lett.*, 1958, **1**, 148–150.
12. Boldt, E., Caldwell, D. O. and Pal, Y., *Phys. Rev. Lett.*, 1958, **1**, 150–152.
13. Boldt, E., Bridge, H. S., Caldwell, D. O. and Pal, Y., *Phys. Rev. Lett.*, 1958, **1**, 256–258.
14. Caldwell, D. O. and Yash Pal, *Rev. Sci. Instrum.*, 1956, **27**, 633–638.
15. Pal, Y. and Rengarajan, T. N., *Phys. Rev.*, 1961, **124**, 1575–1576.
16. Lal, S., Pal, Y. and Raghavan, R., *Nucl. Phys.*, 1962, **31**, 415–446.
17. Pal, Y., Ray, A. K. and Rengarajan, T. N., *Il Nuovo Cimento*, 1963, **28**, 1177–1189.
18. Babu, P., Cowsik, R. and Pal, Y., *Il Nuovo Cimento*, 1963, **29**, 785–800.
19. Pal, Y. and Peters, B., *Mat. Fys. Medd. Dan. Vid. Selsk.*, 1964, **33**, 1–15.
20. Cowsik, R., Pal, Y. and Tandon, S. N., *Phys. Lett.*, 1964, **13**, 265–267.
21. Cowsik, R., Pal, Y. and Tandon, S. N., *Proceedings Indian Acad. Sci. Sect. A*, 1966, **63**, 217–243.
22. Yash Pal and Tandon, S. N., *Phys. Rev.*, 1966, **151**, 1071–1075.
23. Cowsik, R., Pal, Y., Tandon, S. N. and Verma, R. P., *Phys. Rev. Lett.*, 1966, **17**, 1298–1300.
24. Cowsik, R., Pal, Y., Tandon, S. N. and Verma, R. P., *Phys. Rev.*, 1967, **158**, 1238–1242.
25. Chitre, S. M. and Pal, Y., *Phys. Rev. Lett.*, 1968, **20**, 278–279.
26. Cowsik, R., Pal, Y., Tandon, S. N. and Verma, R. P., *Can. J. Phys.*, 1968, **46**, 646.
27. Cowsik, R. and Pal, Y., *Phys. Rev. Lett.*, 1969, **22**, 550–551.
28. Cowsik, R. and Pal, Y., *Phys. Rev. Lett.*, 1969, **23**, 1467–1468.
29. Cowsik, R., Pal, Y. and Rengarajan, T. N., *Astrophys. Space Sci.*, 1970, **6**, 390–395.
30. Peters, B., Lund, N., Cowsik, R. and Pal, Y., *Phys. Lett. B*, 1970, **31**, 553–556.
31. Yodh, G. B., Pal, Y. and Trefil, J. S., *Phys. Rev. Lett.*, 1972, **28**, 1005–1008.
32. Yodh, G. B., Pal, Y. and Trefil, J. S., *Phys. Rev. D*, 1973, **8**, 3233–3236.
33. Eric Ash, Professor Yash Pal, in ref. 2, p. 35.
34. <http://www.unoosa.org/oosa/en/aboutus/history/unispace.html>
35. Chandita Mukherjee, *Professor Yash Pal: A Friend for Life*, in ref. 2, p. 50.
36. Jawaharlal Nehru, *Discovery of India*, John Day Company, 1946.

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## Pushpa Mittra Bhargava (1928–2017)

### *Bhargava and his Camelot for Cellular and Molecular Biologists*

Pushpa Mittra Bhargava's vision for the Centre for Cellular and Molecular Biology (CCMB), founded by him in Hyderabad in 1977, is now the stuff of legend. He had already set his sights on institution building before he hit 30, at a time when most researchers are thinking about establishing their own careers and identities. CCMB was the idyll where about 20 of the finest minds led small-to medium-sized groups of scientists to study major unsolved questions in biology. The groups admitted only the most exceptional doctoral students, selected for that ineffable spark, following a rigorous written test, in two arduous rounds of interviews. 'Describe something interesting you saw on the trip from the train station'. 'Why do phulkas puff up when cooked on an open flame?' 'What is the role of the ball in a ball-pen?' They

worked day or/and night in centrally air-conditioned laboratories, and exchanged ideas in meticulously designed offices, coffee rooms, a lecture hall, or a leafy



P. M. Bhargava (Photograph courtesy: Chandana Chakrabarti).

arbor with its own blackboard, chalk and duster (aptly named Shantiniketan). They had abundant storage spaces, common equipment rooms, walk-in cold rooms, emergency power supply, distilled water on tap, extensive supply of fine chemicals and enzymes, a 24-hour centralized monitoring system, lifts equipped with emergency telephones, and closed circuit TVs. One entered the campus through electrically powered gates, and incongruously for Hyderabad, there even was an octagonal 'Stop' traffic sign on a campus intersection. Receptionists manning the lobby were knowledgeable and helpful. Anyone could engage the emergency vehicle anytime and, thoughtfully, the emergency drivers were provided a lounge to rest in. The monthly pocket writing pad had easily-detached pages and listed useful telephone numbers.

Surya Prakash, soon to become famous, served as 'Artist in Residence'. Artists and sculptors camps were hosted and helped CCMB build up its own art collection, making its lobby a much admired art gallery. M. F. Hussain built his enigmatic 'wall with a gap' mural on the campus, leaving it to the thousands of visitors to ponder its meaning. Supporting staff had a sense of pride in the institution and truly felt they were essential to the success of an enterprise that was larger than them, and whose success would therefore be their achievement. Prizes won in city-wide and national competitions by cooks, drivers, gardeners, typists and photographers were proudly cherished by everyone. Laboratory helpers were awarded much coveted certificates, later framed, for best maintained laboratories and office spaces. Everybody spoke as if CCMB belonged to them. The joke went that when Bhargava accompanied by his officers, Kranthi Kumar and V. K. Sarma walked into CSIR HQ, each was so passionate about CCMB that they could not tell who was the Director.

Bhargava gave close, almost obsessive, personal attention to the physical and organizational aspects of CCMB. He would be there at the construction site late at night, seeing to it that the design was being followed; and he would painstakingly go through, over and over again, lists of the people he wanted to hire for the Centre, not only scientists. Like many visionaries, he was blind to, or chose to overlook, the flaws and limitations of those working for him. While some worried whether public money was being squandered, his magnanimity won him the abiding devotion and loyalty of its beneficiaries, and made the doubters look small-minded. He did not despair even as some research projects began to flounder, and the Nobel Prizes, so recklessly promised, did not materialize. Although these were taken by some as signals of the unravelling of his grand dream, it takes a complete ignorance of science to fail to see the spectacular successes that *did* derive from this dream. To give just three celebrated examples,

elucidation of the genetic structure of Indian populations; the development of improved Samba Mahsuri rice; and the generation of clonal seeds in *Arabidopsis*. Many of the bright youngsters that he recruited paid back his confidence by publishing important research papers, winning national recognition through their awards, fellowships, and prizes, year after year. Some of them went to head universities and national laboratories.

Bhargava was willing to be contrary. In the Indian context, that marks him out as someone extraordinary. Going with the herd and not rocking the boat are typically Indian traits; scientists exhibit them no less than others. He refused to buckle to demands from CSIR for the CCMB charter not to be restricted to basic research. Almost anyone else would have compromised. It was the basic research at CCMB that led to DNA fingerprinting applications (think of the Centre for DNA Fingerprinting and Diagnostics, another one of his legacies), the conservation of endangered species, and CCMB's incubation of a vaccine company (Shanta Biotech). All of this seems almost unbelievable now, given the current frenzy of national agencies mindlessly harping that what is needed are applications and products and not basic research. His 'civil courage' was evident in many other things he did. His public dismissal of homoeopathy invited the wrath of a mob to attack his post-retirement office premises. Many scientists backed his life-long fight against obscurantism and superstition, yet many of them were also perplexed by his seemingly implacable opposition to the use of genetically modified organisms in agriculture. To protest against a perceived disengagement of scientists from matters of societal concern he resigned from the Fellowship of all the three national Science Academies. To protest against the perceived growth of intolerance in the country, he returned his Padma Bhushan. It is almost unthinkable that one of us would turn down a government award or resign from the fellowship of an Academy on grounds of principle (whether the grounds are reasonable or not is another

matter). While many applauded his unprecedented bold protests, there were others who thought it was 'too much'.

Bhargava was a founder of the annual Guha Research Conferences (GRC). Young principal investigators consider an invitation to the GRC as a mark of their recognition as serious researchers. Then, a lucky few invitees are elected to permanent membership, licensed to assume airs of the 'round-table' with equal say in who gets invited to future meetings. The venues for the meetings (Andamans, Khajuraho, Leh, Lakshadweep, Ajanta and Ellora) guarantee that successive generations of PIs will vie to be invited. Within this institution Bhargava created another, the GRC Quiz. He was too ill to attend last year's meeting (in picturesque Diu) and it fell to K. P. Gopinathan, Gopal Pande, and me to conduct the Quiz, and it did not take us long to realize our combined inadequacy to fill his shoes. But the 'GRC family' was good-natured about this, probably out of consideration for their absent 'Bheeshma Pitamah' (to borrow Lalji Singh's evocative description).

Bhargava's kindness and courtesy on the personal level are unforgettable. He welcomed you with a warm smile and the seeming willingness to spend all day in your company. Many, my wife and I included, will long cherish our interactions with eminent artists, sculptors, dancers, actors, film makers, playwrights, writers, cartoonists, lawyers, and other intellectuals because of him. Bhargava died on 1 August 2017, at age 89, and India lost a son who was greater than the sum of his many parts.

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