

was back-breaking, the results were exciting. The laboratory has pioneered measurement of water-use efficiency at the single leaf level using gas exchange systems. Through collaborations with Australian scientists, we established India's first National facility for stable isotopes research to understand plant physiological processes.

The visionary that he was, Udayakumar clearly realized that the success of improving physiological traits depends on methods for introgressing them into an elite background. His amazing perseverance made him learn both forward and reverse genetic approaches. He developed strong groups of colleagues and students to work on cloning genes and identify quantitative trait loci (QTL) and devised methods to transfer these genes and QTL through transgenic and molecular breeding approaches. One of the testimonies for this 'out-of-the-box' thinking was the development of an image-based method to assess the canopy health of a plant. For this, he was bestowed with the 'Merito-

rious Invention Award' by ISRO, way back in 1985. Image-based phenotyping is now being considered as one of the most precise approaches, which he had envisioned more than three decades ago.

Udayakumar was a guiding force for revising plant physiology syllabi at the postgraduate level and set a high standard of teaching and research in India. He spearheaded efforts of establishing high-end phenotyping facilities in the country, including the mini lysimeter-based drought simulator phenomics facility at UASB. This facility is an illustration of his consistent perseverance to automate the gravimetric methods of measuring water use by plants in real time. To the best of our knowledge, the drought simulator facility is the largest outdoor phenotyping platform. Udayakumar was instrumental in mentoring several laboratories in India and helped them establish state-of-the-art facilities, including advising private seed companies.

He was conferred with the Lifetime Achievement Award by ITC Ltd (1997)

and the Indian Society for Plant Physiology (2016), and was an elected Fellow of all three major Science Academies in India and the National Academy for Agricultural Science (NAAS).

Till the last minute, Udayakumar was thinking only of science and according to him, 'learning is interesting'. Persons like Udayakumar traverse this universe once in a millennium. Fortunate are we, his students, who walked this earth at the same time as him.

M. S. SHESHSHAYEE^{1,*}
K. V. RAVISHANKAR²
M. G. PURUSHOTHAMA³

¹*Crop Physiology,
University of Agricultural Sciences, GKVK,
Bengaluru 560 065, India*

²*Division of Biotechnology,
Indian Institute of Horticultural Research,
Bengaluru 560 089, India*

³*I&B Seeds Pvt Ltd,
Bengaluru 560 060, India*

*e-mail: msshesh1@uasbangalore.edu.in

Hare Krishna Pradhan (1945–2020)

Bird flu or avian influenza is considered as one of the dreaded diseases with certain virulent strains like H5N1 or H7N7, which caused epidemics in about 39 countries of the world with high public health significance. More than the disease itself, the panic causes loss of thousands of crores of rupees through various means and is the main cause of concern. The chickens of the area under certain radius are culled to contain the disease as a first hand measure. In this process, the contribution of National Institute of High Security Animal Diseases (NIHSAD) is truly remarkable for successfully diagnosing the viral strains. It is helping to control and prevent the disease from spreading further. The man behind the creation of the world-class laboratory was Dr Hare Krishna Pradhan, popularly known as the 'Bird-Flu Man of India' due to his immense contribution in this field. According to him, 'bird flu has the potential to spread very fast, it has no treatment, and could cause major epidemics'. In India, this epidemic was first surfaced in 2006, and even at present day also, it is being reported at several isolated places across India.

Pradhan was born in a poor teacher's family in Khajuripada village in Khand-

amal district (a remote area) of Odisha on 1 April 1945. Being one of the nine siblings to his parents, he has undergone



rigorous challenges for completing his studies with fellowships throughout his career. He was deeply inspired by his father to move ahead through honesty and discipline along with continuous perseverance. His teacher, G. C. Mohanty, inspired him to continue career in veterinary science as it is not the subject, but the perseverance, love and interest in the subject matters. Pradhan completed his Bachelors in Veterinary Science and Ani-

mal Husbandry and Masters in Veterinary Pathology from Orissa Veterinary College, Orissa University of Agriculture and Technology in 1969 and 1971 respectively. He subsequently moved to Indian Veterinary Research Institute (IVRI) and received the doctoral degree in Pathology in April 1976.

After obtaining Ph.D., he joined IVRI as a scientist in the Division of Avian Diseases. Considerably, the poultry industry – representing meat and egg-producing birds – had started flourishing with the improved genetics and efficient strains. Simultaneously, the demand on avian disease diagnostics and investigation was also increasing. Pradhan devoted his attention to a variety of prominent poultry diseases like infectious bronchitis, herpes virus-induced cancer, egg drop syndrome, duck plague, etc. from 1977 to 1990. Since then, many of the novel findings of his team are referred in standard textbooks even abroad as well. He successfully developed new *in vitro* and *in vivo* models to study infectious bronchitis and Marek's disease¹. Pradhan was deputed to Holland, England and Switzerland for four months for a training on biosafety during 1988–89. His career got a new turn after this training as he shifted to

Bhopal in 1990 for establishing the biosafety level four (BSL-4) laboratory known as National Institute of High Security Animal Disease Laboratory (HSADL; currently renamed as NIHSAD), which is accredited by the World Organisation for Animal Health (OIE). He led from the front as head of the laboratory (1997–2007) and was responsible for creating the best possible infrastructure of international standards, making it one of the best 10 containment laboratories in the world. This laboratory establishment nearly fulfilled its purpose, as since then it has been continuously handling many exotic diseases of livestock and birds. Moreover, the laboratory played an instrumental role in the development of diagnostic tests and vaccines aimed at prevention and control of these diseases.

During his tenure, as many as eight exotic diseases important to India were handled in the laboratory. Diagnostic tests were developed indigenously for these diseases along with development of killed avian influenza vaccine using locally isolated H5N1 virus^{2,3}. For the first time, a real time (RT)-PCR test for avian influenza was developed ahead of USA. Development of these diagnostic methodologies for highly pathogenic avian influenza H5N1 strain in 2006 brought fame to the laboratory, country, veterinary and the health profession. Later, he was nicknamed as ‘Bird Flu Man of India’. During 2001 to 2003, four new diseases, not known to exist in India until then, were diagnosed in the imported animals and thus their entry to the country was prevented. He was also responsible for designing two BSL-3 laboratories for National Institute of Virology, Pune, which is now termed as India’s top laboratory responsible for investigating viral outbreaks in human beings; the other one was the animal disease lab of Defence Research and Development Organisation (DRDO), Gwalior. Many peers recognize him as Father of Biosafety in India. He was also responsible for creating specific pathogen-free (SPF) facility at NIHSAD, Bhopal for producing SPF eggs, which help advance research into many kinds of diseases.

After superannuation from the service in 2007, Pradhan joined World Health Organization (WHO) as National Consultant (Avian Influenza) on 15 January 2008 and served WHO until 31 March 2012. During his association with WHO, he was contributory in upgradation of Na-

tional Institute of Communicable Diseases (NICD) to National Centre for Disease Control (NCDC), similar to Centre for Disease Control (CDC) of USA through the Ministry of Health, Government of India. As medical and veterinary fraternity need to go together to control zoonotic diseases and also for maintaining ‘one health’ concept, he organized two workshops on biosafety and biosecurity for medical and veterinary professionals with the support of WHO. He was in liaison with both medical and veterinary professionals for control of avian influenza and many of the diseases that transmit to humans from animals (zoonosis).

Pradhan guided several students for their masters and doctorate degrees in veterinary pathology, biotechnology and immunology. He published more than 142 research papers in national and international journals of repute with primary focus on avian and livestock diseases. Further, Pradhan served as a governing body member of National Institute of Animal Biotechnology. In addition, he guided and evaluated many ICAR institutes as a Research Advisory Council and Quinquennial Review Team member. He also acted as chairman of National Agricultural Innovation Project on toll-like receptors, which could identify many innate immunosensors and many important receptors in livestock. He was a visiting professor to Manipal University for a period of 3 years (2012–2014) and biosafety consultant to Institute of Microbial Technology, Chandigarh. He was also a member of the technical committee for the establishment of bone marrow transplantation and stem-cell research facility under Banaras Hindu University, Varanasi. He was a fellow of the Indian Association of Veterinary Microbiology, Immunology and Infectious Diseases and the Indian Society of Veterinary Immunology and Immunopathology.

Though known for his simplicity, there was a sense of belongingness in his work, which he loved for the sake of science and like a soldier stood with his army of scientists, research scholars, junior- and senior research fellows and other staff for helping to curb the intrusion of possible invading diseases from abroad and the arising zoonoses in India⁴. The BSL-4 laboratories need stringent norms to follow, necessitating truly dedicated researchers to accomplish the tasks as they very often need to burn midnight oil to reach their destiny of either developing a

disease testing tool or methodology or a vaccine. At the times of bird flu, they had to screen hundreds of samples of blood and faeces of birds from several poultry farms across India looking for the bird flu virus that biologists have named ‘H5N1’ and several other strains.

Akin to most of the dedicated scientists, his personal life was simple. Being a devout researcher and working for an area that really mattered in both the economic and human health point of view, his family (wife Krishnapriya, a son and a daughter), used to get only certain quality time from him. Pradhan was always dreaming about establishing a well-equipped laboratory to deal with a probable threat of bioterrorism, which may be a harsh reality in the near future according to his perception⁵. Pradhan truly served the science by providing a clear vision of preventing exotic diseases and epidemics through coordinated joint efforts of medical and veterinary professions, thereby pioneering the one health concept in India. Indian Veterinary Profession pays sincere homage to the loss of the personality par excellence who left us on 7 August 2020.

1. Dandapat, S., Pradhan, H. K. and Mohanty, G. C., *Vet. Immunol. Immunopathol.*, 1994, **40**, 353–366.
2. Rajput, R. *et al.*, *Front. Immunol.*, 2015, **6**, 440.
3. Bhatia, S., Sood, R., Mishra, N., Pattnaik, B. and Pradhan, H. K., *Res. Vet. Sci.*, 2008, **85**(1), 39–45.
4. Pattnaik, B. *et al.*, *Curr. Sci.*, 2006, **91**(1), 77–81.
5. Kar, S. S., Pradhan, H. K. and Pattnaik, B., *Indian J. Med. Spec.*, 2012, **3**(1), 43–48.

SUSEN K. PANDA¹
M. S. MAHESH²
RANJAN K. MOHANTA^{3,*}

¹*Department of Veterinary Pathology, College of Veterinary Science and Animal Husbandry, Orissa University of Agriculture and Technology, Bhubaneswar 751 003, India*
²*Faculty of Veterinary and Animal Sciences, Banaras Hindu University, Mirzapur 231 001, India*
³*Krishi Vigyan Kendra, ICAR-National Rice Research Institute, Cuttack 753 006, India*
**e-mail: mohanta.ranjan@gmail.com*