

BIENVENIDO OCHOA JULIANO:

Shaping the world's evolution through rice research

by Carla A. Omega*



Rice, the lifeblood of Asia, is not just the world's most popular food. For more than half of humanity, it's a way of life that defines cultural identity and represents the very basis of socioeconomic stability, national security and global unity. Rice also has great scientific significance. The development of environmentally sustainable production of high-yielding rice varieties through science and technology upon the inception of the International Rice Research Institute (IRRI) has helped alleviate worldwide poverty and hunger, and facilitated the improvement of countless livelihoods. But IRRI would not have realized its purpose or achieved its success today without the invaluable scientific contribution served by one of the brightest and most prolific Filipino national scientists.

Born from a family of accomplished scholars, it is not surprising that even at a young age, Bienvenido O. Juliano showed brilliance and academic excellence. He always came among the top of his class, and then graduated early in college from the University of the Philippines-Los Baños (UPLB) with a *magna cum laude* in B.S. Agriculture, and eventually became the youngest, straight A's Ph.D. graduate of organic chemistry in Ohio State University (OSU) at only the age of 22.

Dr. Juliano began his career as an educator. He taught agricultural chemistry in UPLB immediately after he obtained his bachelor's degree in 1955, and on the following year, became a teaching assistant in the Department of Chemistry in

OSU. It was then in the hallowed halls of OSU Chemistry campus that Dr. Juliano started to delve into research by first working as a research assistant, to be designated later on as a Fellow of the National Science Foundation in 1958, and a Fellow of the C.F. Kettering Research Foundation from 1958 to 1959. As an organic chemist, he initially made several important publications in the *Journal of American Chemical Society* and the *Journal of Organic Chemistry* as he explored alternate methods for the preparation of stable, crystalline dinitrophenyl ether derivatives of alditols, formulated chemically modified chondroitin sulfates, and synthesized ethyl 1-thio- α -D-galactofuranoside.

After receiving his Ph.D. in 1959, equipped with the latest knowledge and technical skills in chemistry, Dr. Juliano decided to come back to the Philippines, willing to put his expertise in the service of his countrymen. It wasn't long before he had quit his job as head chemist in the Philippine Refining Company and relinquished his position as a chemistry professor in the Far Eastern University to pursue what would become his lifetime passion which inevitably led him to earn his distinction as the foremost world authority on rice grain quality.

He returned to Los Baños, Laguna, where the then newly established IRRI was also situated. During that time, however, much scientific work had already been performed on the cereal chemistry of wheat, and what little was known on the nature of the developing and mature tropical rice grain. At the early stage of development, IRRI therefore was faced with the challenge of employing a scientist with suitable training and educational background who would fulfill the two main objectives of their Chemistry Department: (1) to examine the chemical nature of tropical rice grain by studying the structure, physicochemical properties, quality and nutritive value of starch, protein and

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lipids; and (2) to understand the properties of developing and germinating rice grain and rice straw. He accepted the post as associate chemist offered by IRRI in 1961 proved himself to be very much capable of handling the enormous tasks and responsibilities given to him through diligence, determination, and commitment. By 1968, he was appointed chemist and head of IRRI's Department of Chemistry, which was renamed Department of Cereal Chemistry in 1983. The department became part of the Plant Breeding, Genetics and Biochemistry Division of IRRI where Dr. Juliano worked until his voluntary retirement in 1993.

In his 32 years of notable service, Dr. Juliano has become



Figure 1. Dr. Juliano in his laboratory in PhilRice showing the field staining method for amylose content type.

instrumental in the enhancement of grain quality of rice from his researches conducted in IRRI and in cooperative studies with scientists in related disciplines. He devised and improved various methods and strategies for quality assessment that paved the way for the rationalization of breeding technologies all over the world.

The valuable information resulting from his impressive contributions to rice science was made accessible for the benefit of all mankind by publishing over 380 articles and books on rice and rice-based food products in internationally refereed journals and in national and regional publications in the Philippines.

He authored a number of monographs, such as “Rice in Human Nutrition,” that he wrote for the Food and Agriculture Organization in 1993, and “Grain Quality Evaluation of World Rices,” that he compiled for IRRI in 1993. He was invited to visit cereal laboratories and give recommendations to rice quality breeding programs in several countries such as Vietnam, Myanmar, China, Bangladesh, Cuba, and Taiwan. The IRRI monograph was soon translated into Japanese in 1999. He also released a 10-chapter book in 2003 and 2007 entitled, “Rice Chemistry and Quality,” which was launched by the Philippine Rice Research Institute (PhilRice), an agency that Dr. Juliano himself helped to build grain quality capability after he left IRRI, and where he still pursues his rice research as its senior consultant/expert (Figure 1). The founding of the PhilRice center has set off the promotion of rice research and development (R&D) activities in the Philippines in response to the needs and welfare of all Filipinos.

Dr. Juliano's most frequently cited publication is the American Association of Cereal Chemists (AACC) monograph, “Rice Chemistry and Technology,” in its second edition published in 1985. When it was issued, he made a deal with the AACC to allow IRRI to procure about 500 copies at subsidized cost in order to distribute them free of charge to libraries in developing countries, especially in Asia where 90% of world rice is grown and consumed, but which could hardly afford the reference book's price.

From his researches, it was revealed that amylose content (linear starch) is a key factor that affects the properties of cooked rice in tropical Asia, and in 1965, he first detailed the protein-body nature of milled rice protein through light microscopy. He also discovered a crystalline type of rice protein bodies in 1977 and



Figure 2. Dr. Juliano being given awards by various learned institutions and organizations (clockwise, from top left): the Medal of Merit by President S. Suzuki of the Japanese Society of Starch Science in Tokyo, 1982; the Thomas Burr Osborne Medal Award by President L. Hood of the American Association of Cereal Chemists in San Diego, California, 1988; the Outstanding Scientist and Technologist Award from the ASEAN Science and Technology Week by a Vietnamese official in Hanoi, 1998; and the rank and title of National Scientist by the Philippines' President Joseph Estrada with Secretary Filemon Uriarte Jr. and Mrs. Linda Juliano, 2000.

the involvement of the core of spherical protein bodies as the indigestible protein fraction of cooked rice. The higher levels of bound starch synthase, or waxy gene product found more in indica than in japonica rice starch, were proven as well in his analyses. Even the nutritive value of rice with increased protein content was surveyed by chemical assays and cooperative feeding trials in humans and rats. Among Dr. Juliano's other accomplishments with remarkable scientific implications include the development of the gel consistency test for measuring cooked rice hardness in 1973, and the neutral gel consistency for glutinous or waxy rice in 1974. He also modified the amylose test by using acetate buffer as solvent, producing stable results.

In a collaborative study in 1982, Dr. Juliano identified that the major aroma principle of cooked aromatic rice is 2-acetyl-1-pyrroline, which was patented by the U.S. Department of Agriculture. A year later, he detected the same compound in pandan leaves.

Dr. Juliano's unparalleled expertise in rice science gained through years of hard work and dedication has been recognized by his membership in the editorial board of the *Cereal Chemistry* from 1991 to 1994, of the *Philippine Journal of Science* from 1999 to 2001, and his continued membership in the editorial boards of the *Food Reviews International* and the *Journal of Cereal Science*, positions he has held since the 1980s. In addition, he became involved in science and technology public service, advocacies, and legislation when he served as President of the *Kapisanan Kimiko ng Pilipinas* from 1982 to 1983 and chair of the NAST Ad Hoc National Committee on Virgin Coconut Oil Research for Health from 2004 to 2007.

Throughout his scientific career, Dr. Juliano has consistently demonstrated leadership and excellence in the field of research, a fact recognized worldwide by many prominent institutions and organizations. He was a recipient of the Ten Outstanding Young Men (TOYM) Award in 1964 accorded by the Junior Chamber of Commerce of the Philippines for his achievements in science. He is the only non-Japanese Asian to be presented with a Medal of Merit in 1982 by the Japanese Society of Starch Science. He is the only Asian and rice scientist to have received the Thomas Burr Osborne Medal Award from the American Association of Cereal Chemists in 1988. He is the first Filipino to be honored by the Association of South East Asian Nations (ASEAN) as an

Outstanding Scientist and Technologist in the 1998 ASEAN Science and Technology Week. In 2000, the rank and title of National Scientist was bestowed upon him by the President of the Philippines (Figure 2).

Dr. Juliano was a recipient of the President of the Republic of the Philippines Jose Rizal Pro Patria Award in 1976, and was elected into the National Academy of Science and Technology of the Philippines in 1979. In 1993, the National Research Council of the Philippines conferred on him the Cluster I (Physical Sciences) National Researcher Award during its 60th Jubilee Celebration. A plaque of recognition for lifetime research on rice quality was awarded to him by IRRI in 2004. He is included in "Who's Who in the World 2009" (26th ed., Marquis Who's Who, New Providence, NJ, USA), "Who's Who in Science and Engineering 2008-2009" (10th ed., Marquis Who's Who), Asian Admirable Achievers (vol. 4, Rifacimento International, New Delhi, India, 2009), "Great Minds of the 21st Century" (2005-2006 ed., American Biographical Institute Inc., Raleigh, NC, USA), and "Outstanding Scientists of the 21st Century" (1st ed., International Biographical Centre, Cambridge, England, 2006). He is the only Filipino scientist included in the Institute of Scientific Information's Highly Cited Researcher database (in agricultural science).

In addition to his decidedly heroic endeavors in the field of science, Dr. Juliano remains a generous and supportive leader worthy of emulation. An esteemed mentor, he imparted vital learning and shared his vast experience with graduate and undergraduate students alike in every part of the globe, and carefully trained many scientists, postdoctoral fellows, and research staff from international rice programs, all of whom further contributed to the advancement of rice science and technology. Certainly, the impact of Dr. Juliano's scientific achievements not only extends to scholars, but also embraces those whose interests lie beyond that small grain of life.

Dr. Juliano is, indeed, an inspiring influence and exemplary role model who brought honor and national pride for the Philippines, as well as shaped the world's evolution by using the tools of science and technology. For those who aspire to accomplish as much as he had, definitely, there's still a great deal of work left to be done. As the famous Filipino saying goes, "Marami ka pang kakaining bigas." **PSL**