

# ASUNCION K. RAYMUNDO:



## Peering into microbes and pioneering molecular microbiology in the Philippines

by Edwin N. Camaya and Evanjill Alcantara

**T**here are people who are fortunate enough to know from the beginning what they would like to be for the rest of their lives. There are also many successful people who can point to an incident in their lives which determined the course of their careers or the direction their lives would take. Both of these would hold true in the case of Dr. Asuncion Karganilla-Raymundo, a pioneer in her field who is one of the most significant names in Philippine science today.

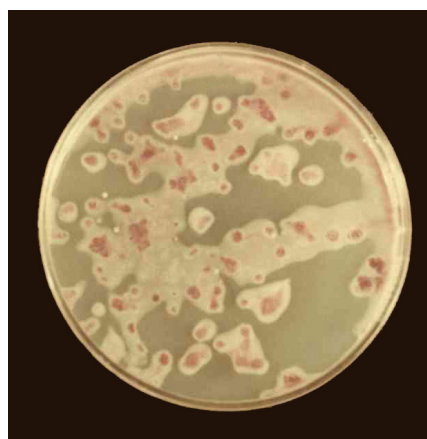
Dr. Raymundo had wanted to be a schoolteacher like her mother and intended to pursue an Education degree. Instead, due to economic reasons, she was sent to study at the UP (University of the Philippines) College of Agriculture, where a sister had graduated and was then working. It did not mean the end of her dream to teach. It simply opened another door, another route to it.

By this time, another dream had taken shape, as a result of her experiences in high school. She was able to peer through a microscope only once or twice during her entire stay in high school. But looking into the microscope opened her to an exciting new world, at once tiny and full of possibilities. She resolved to choose a course which would allow her unlimited access to this wonderful piece of equipment and to the tiny world of microbes which it unlocked. She did that when she got her B.S. Agriculture degree (*cum laude*) with a major in Soil Microbiology.

After college, she immediately found work as a microbiologist in Los Baños. Then she further nurtured her love for microbes, when she chose to pursue a master's degree (in Phytobacteriology) at the University of Hawaii. Upon her return home, she became one of the founding

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faculty of the newly-established College of Sciences and Humanities in UP Los Baños (UPLB) in 1972. Not long after came marriage and a family, which did not deter her from pursuing a PhD at the University of Illinois at Urbana-Champaign. Upon her return to UPLB in 1980,



Banana afflicted with *moko* bacterial wilt (leftmost figure). Cooking banana showing *bugtok* infection or bacterial hard pulp that causes fruit hardening, uninfected bananas are also shown for comparison (top figure) are. *Ralstonia solanacearum*, the causative agent of the two diseases grown in a petri plate (left).

she plunged into both instruction and research. Later, she received postdoctoral training in microbial genetics at IRRI (International Rice Research Institute) in Los Baños, Monash University (Australia), Osaka University and Kansas State University.

Today, Dr. Raymundo is an outstanding professor in UPLB who is known for her mastery of the art of teaching. She was the Outstanding Teacher Awardee for the Biological Sciences in UPLB in 1987, and she received the UP Presidential Diploma of Merit in Teaching in 1988. She is responsible for the education and development of many microbiologists in the country. A total of ~130 students have passed through her hands as advisees. She has trained undergraduate and graduate students in research by involving them in her research projects, with the students obtaining their degrees in the process.

Dr. Raymundo has received even greater recognition for her research. She is a pioneer in the utilization of biotechnology-based approaches to problems in agriculture. This was back in the late 1980s to the early 1990s, when microbial genetics and molecular biology were still in their infancy in the Philippines. Applying these leading-edge

techniques, she and her collaborators studied the genetic diversity and molecular detection of two microorganisms, *Xanthomonas oryzae* pv. *oryzicola*, the causal organism of bacterial leaf streak of rice, and *Ralstonia solanacearum*, the causal bacterium of wilt of many solanaceous crops and of banana.

With *X. oryzae* pv. *oryzicola*, she and her colleagues studied the population structure and genetic diversity of the pathogen to be able to deploy the appropriate resistant rice variety based on the particular bacterial strain dominant in a particular growing area. Her study on the cloning of a region of the hypersensitivity and pathogenicity gene in *Xanthomonas oryzae* pv. *oryzicola* has led to the development of DNA probes/primers which permit pathogen detection at low levels. Another technique emanating from her work, which can determine the prevalent strain of a pathogen in a locality, allows the selection and planting of the appropriate variety resistant to a pathogen strain. Likewise, Dr. Raymundo and her colleagues have devised an innovative molecular technique that simplifies the study of genetic variation in destructive microorganisms.

The other organism that Dr. Raymundo worked with, *Ralstonia solanacearum*, has been found to be associated with two banana diseases showing different symptomatologies: *moko*, a worldwide disease which causes wilting of banana plants, and *bugtok*, which causes blackening and hardening of the fruit of the cooking variety of banana. Dr. Raymundo and her colleagues have shown unequivocally by molecular genetic methods that the causes of the *moko* and *bugtok* diseases of banana are actually the same pathogen attacking different varieties. This has debunked the common belief of banana workers that the causal pathogens of the two diseases are different. This piece of information is a critical basis of an effective disease management strategy in the banana industry.

For both organisms, Dr. Raymundo's team has devised an effective molecular technique for the identification and detection of these pathogens. This is important in plant quarantine, as the importation and movement of planting materials from other places pose an obvious threat to agriculture.

Dr. Raymundo has also worked on antibiotic-producing microorganisms and their local production. She is the first to report genetic

Dr. Raymundo has received the following prestigious research awards from UP and other institutions and award-giving bodies: UP Outstanding Professional Award in the Natural Sciences (Biology-Microbiology) (2007), Regional and National Winner, *Republica* Outstanding Research Paper Award from the Commission of Higher Education (2004), Distinguished Award in Biology from the National Research Council of the Philippines (NRCP) (2002), Crop Science Society of the Philippines Achievement Award in Research (2002), *Pantas* Outstanding Researcher Award from PCARRD, DOST (2001), Eusebio Garcia Award for Molecular Biology/Biotechnology from the NRCP (1996), UPLB Most Outstanding Researcher (1996), Most Outstanding Microbiologist from the Philippine Society for Microbiology (1995). She is among the foremost scientists of the Philippines and in 2002, she was conferred the title of Academician of the National Academy of Science and Technology—one of the youngest recipients ever to receive this honor during that time." (There are many younger ones who were accepted at a later time.).

In extension, she has organized training courses in recombinant DNA techniques, helped develop the field of microbial genetics, and

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manipulation in an important antibiotic-producing organism, *Bacillus polymyxa*, using the technique of protoplast preparation and fusion. This method can lead to strain improvement, which can increase antibiotic yield. Dr. Raymundo is responsible for the development of a simple process to produce tylosin using an improved strain and locally available substrates. In the Philippines, tylosin is still very expensive because it is being imported, preventing its large-scale utilization. Together with her colleagues, she showed the possibility of producing antibiotics like streptomycin, penicillin, pleuromutilin (a therapeutic), avermectin (an antihelminthic) and erythromycin using locally available substrates. Dr. Raymundo has also shown the antibiotic potential of marine sponges and bryophytes in the Philippines. This discovery provided the impetus for marine natural products researchers to pick up the trail that she had blazed.

Currently, the research interests of Dr. Raymundo revolve around bioremediation, and the pioneering use of environmental DNA in the study of the diversity of microbes from unique environments, e.g., thermophilic mudsprings in Mt. Makiling. This technique circumvents the need to isolate pure cultures of the microorganisms, and allows the analysis of the diversity of microbes from DNA directly isolated from the environment.

played an active part in the standardization of the microbial genetics and microbiology curricula in the country.

On top of being a researcher and professor in Microbiology, Dr. Raymundo served as Director of the Institute of Biological Sciences for seven years, and currently serves as Dean of the College of Arts and Sciences (CAS) at UPLB. She sincerely envisions establishing a research culture among constituents of the College, which she hopes to achieve by providing the necessary environment and infrastructure. Dean Raymundo is also known to continually boost the morale of the faculty, students, and administrative staff to bring the UPLB CAS to greater heights of excellence.

Dr. Asuncion K. Raymundo has achieved so much in her lifetime career of ~40 years as a biologist—from being a researcher, professor, scientist, and now as Dean and Academician. As a prolific researcher, she has exerted a great impact on the field of microbiology, while setting and maintaining standards in the practice of the profession and in microbiology education. The list of her achievements is long, and continues to grow. With a prolific and dedicated researcher like her, one knows that there is much more to come. As it is, she has already left an indelible mark on microbial genetics and microbiology in the country, for which she will always be remembered.