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1978-1980	M.Sc., Department of Genetics and Molecular Biology, Centro de Investigación y Estudios Avanzados del I.P.N.
1981-1984	Ph.D., Department of Genetics, State University of Gent, Belgium
1984-1986	Postdoctoral studies Department of Genetics, State University of Gent, Belgium

Honors

1984	The Minoru and Ethel Tsutsui Distinguished Graduate Research Award in Science, The New York Academy of Sciences
1987	Javed Husain Award for Young Scientists, UNESCO, Paris
1989	National Science Award, Mexican Academy of Scientific Research
1993	Third World Academy of Science Award in Biology
1998	RedBio Medal, Latin American Biotechnology Network
1999-present	President Elect, International Society of Plant Molecular Biology
1999-present	Scientific Advisory Board, Donald Danforth Center

Patents

Dr. Herrera-Estrella has produced 5 international patents in plant
biotechnology.

**Engineering Aluminum-Tolerance
and Enhanced Nutrient Uptake in
Transgenic Plants**

Soil stress is one of the most important factors limiting agricultural productivity. In tropical and subtropical regions of the world, soil acidity and low phosphate availability are two of the most important constraints affecting plant productivity. Acid soils comprise around 40% of the world's arable land, while low phosphate availability affects over 60% of the land currently used for agriculture. During plant evolution, genetic differences have arisen allowing certain plants to grow in unfavorable environments, including soils with acidic pH or low phosphate availability. Several studies have suggested that plants better adapted to growth in acidic soils or soils with low phosphate availability, excrete organic acids to overcome aluminum toxicity, the most important factor limiting plant productivity in acidic soils. Organic acid excretion has also been implicated in the capacity of some plant species to utilize insoluble forms of phosphate, which are not readily available for plant uptake. Given the importance of organic acid excretion in aluminum-tolerance and phosphate uptake, we developed transgenic plants with an increased capacity for the synthesis and excretion of organic acids. Plants that overproduced organic acids were found to have an increased tolerance to toxic concentrations of aluminum and an enhanced capacity for phosphate uptake. Citrate overproducing plants have a higher yield in acidic soils and in soils with low phosphate availability, require less phosphate fertilizer to reach full productivity. The potential benefits of citrate overproducing plants for small farmers and to the environment will be discussed.