ASPB Pioneer Member

Pon (Jayakumar Pon Samuel)

Plant cell biologist exploring cellular plasticity, nano-delivery biology, Nucleic acid free editing and next-generation crop engineering.

Plant cells possess an extraordinary capacity for developmental plasticity, a property that has shaped both my scientific curiosity and my career. My work has spanned academic discovery, industrial biotechnology innovation, and leadership within the global plant science community, with a consistent focus on understanding and harnessing plant cell plasticity to translate biological discovery into agricultural technologies.

I was born in Nazareth, Tamil Nadu, and grew up across South India, including Munnar, Kerala. My fascination with plants was shaped early by landscapes, field experiences, and teachers who viewed plant biology as both science and stewardship. At Madras Christian College, where I later served on the Botany faculty, I came to appreciate that plant science realizes its greatest value when discovery, application, and societal responsibility converge. These formative years established the intellectual and ethical foundation that continues to guide my work.

During my early academic career at Madras Christian College, I helped establish laboratory facilities and curriculum for plant tissue culture and *in vitro* biology, introducing students to experimental systems that allow plant cells and tissues to be studied outside the whole plant. Our research group also initiated work on in vitro propagation of plantation crops such as tea and cashew, demonstrating the value of tissue culture for large-scale propagation of economically important species.

My doctoral work in plant physiology and plant growth regulator biology deepened my interest in cellular plasticity. I demonstrated auxin-like activity for two previously unknown compounds, contributing to the understanding of hormonal regulation in plant development. Earlier, as part of the research group led by Professor P. Dayanandan to whom I dedicate this honor, I participated in studies on unusual internal air channels in *Gloriosa* species. Encouraged by Katherine Esau, Dr. Dayanandan, my research advisor and later my senior colleague characterized the epidermal organization of these channels for the first time. These studies later led me to examine cuticular and epicuticular wax composition in *Gloriosa rothschildiana* and other plant systems including Leek, contributing to plant surface lipid biology (Plant Science 1998 133, (2), Pages 145-154; Plant Physiol. 1998 116(3): 901–911).

These early observations on plant structure and surface organization shaped my later interest in how molecules move across plant cellular boundaries. Questions that began with anatomy evolved into a broader exploration of how DNA, RNA, and proteins can be delivered into plant cells while preserving cellular integrity (US8722410 B2, US8609420 B2, US 8581036 B2, WO2010118077).

I later worked in Germany on the in vitro selection of salt-tolerant rice lines, gaining early experience applying plant cell culture to crop improvement. At Ruhr University Bochum, in Professor Elmar W. Weiler's laboratory, I developed HPLC-based methods to characterize metabolites in *Corydalis sempervirens* and investigated unusual features of plant suspension cultures, including the role of cyanobacterial endophytes in *Ginkgo biloba* and helped with the experiments using Bryonia using Jasmonic acid. I also contributed to establishing plant tissue culture capabilities within the department.

My postdoctoral work at the Samuel Roberts Noble Foundation focused on peanut transformation and development of experimental systems for studying oil metabolism in collaboration with industry partners, P&G and DuPont-Pioneer. During this period, I also investigated brassinolide-mediated elongation of dormant buds in in vitro meristem cultures, providing insights into hormonal regulation of organoid development. In parallel, I worked with Dusty Post-Beittenmiller on plant surface lipid biology, characterizing epicuticular wax accumulation in leek tissues and reporting developmental patterns of wax biosynthesis.

I subsequently served as Research Faculty at the University of Illinois at Urbana-Champaign, where I contributed to the development of a public soybean transformation platform as part of a consortium led by Professor Jack Widholm. I trained graduate and master's students in soybean and maize in vitro systems and coordinated collaborative research programs bridging academia and industry.

My career then transitioned to industry, where I spent more than two decades across Dow AgroSciences, the

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Agriculture Division of DowDuPont, and Corteva Agriscience. In these roles, I worked at the interface of discovery biology and agricultural deployment, advancing platforms in crop transformation, genome editing, and trait integration. A central theme of my industrial work has been the development of minimally invasive molecular delivery systems in plants. This included plant-derived cell-penetrating peptides and nanoparticle-mediated delivery approaches for DNA, RNA, and protein transport. These efforts contributed to DNA-free genome editing strategies and helped establish delivery biology as a key frontier in plant biotechnology (Plant Biotechnology J. 2020 May;18 (5):1307-1316.). I also contributed to trait development programs with significant agricultural impact. Among these, the Enlist E3 soybean platform became widely adopted in U.S. agriculture, demonstrating how advances in plant biotechnology can translate into durable value for farmers at scale (PNAS. vol. 107: (47) 20241-20245).

During my later years at Corteva Agriscience, I served as Distinguished Laureate leading innovative research in Cell Fate and Reprogramming. As part of a multidisciplinary effort, we explored how plant cell identity can be redirected through controlled molecular cues to enable on-demand plasticity. While much of this work remains proprietary, it involves the use of stem cell regulators, along with chromatin-modifying approaches including hDAC inhibition. Leading this effort, while mentoring scientists to appreciate plant cell plasticity beyond classical notions of totipotency, was among the most rewarding phases of my career.

Professional society engagement has been an integral part of my scientific journey. I have been an active member of ASPB for many years and value its role as an intellectual home for plant science. I have contributed to symposia, mentored early-career scientists, and supported efforts to bridge academic discovery and agricultural innovation. I have also been deeply engaged with the Society for In Vitro Biology (SIVB), where I currently serve on the Board of Directors and have been honored as an SIVB Fellow and Distinguished Scientist. As Program Chair for the Plant Section, I helped organize conferences, workshops, and symposia advancing plant regeneration, cell biology, and delivery technologies. I view service to scientific societies as essential to sustaining vibrant and collaborative research communities.
Today, as Chief Innovation Officer at Insignum AgTech, I focus on integrating delivery biology, regeneration systems, and precision editing to unlock hidden regulatory and epigenetic layers of plant genomes. I believe the next frontier in plant biotechnology lies not only in editing capability, but in improving delivery efficiency, regeneration biology, and system-level integration.

Mentorship has been one of the most meaningful dimensions of my career. Across academia and industry, I have been privileged to mentor students and scientists at multiple stages of their careers. Any success I have experienced reflects the mentors who guided me and the collaborative environments that value shared purpose over individual recognition.

ASPB represents a community that balances rigor with imagination and discovery with responsibility. To be recognized as a Pioneer by this society is deeply humbling. I accept this honor not as a culmination, but as encouragement to continue advancing plant science in ways that are innovative, translational, and inclusive.
The plant genome still holds immense untapped potential. My lifelong goal has been—and continues to be—to help reveal it, one discovery and one generation of scientists at a time.
— **Pon**
Revealing the hidden potential of plant cells.