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Genetically encoded molecular automation algorithm orchestrates transcriptional reprogramming, photosynthesis and seed yield efficiency in *Arabidopsis*

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In his theory on the natural selection of species, Darwin proposed that all living organisms strive to transfer their species-specific traits to their progeny. Accordingly, all cellular and organismal processes are subordinated to this biological imperative. In this context photosynthetic efficiency, growth, water use efficiency (WUE) and seed yield are the key traits for a plant's Darwinian fitness. Plants have developed discrete, dynamic and emerging physiological responses that are able to simultaneously process various environmental stimuli and, adjust transcription profile thereby, to optimize Darwinian fitness under short- and long-term changes in the natural environment. We discovered that optimization of photosynthesis, transpiration, nonphotochemical quenching and foliar hydrogen peroxide is achieved in a way similar to that defined by the cellular automation algorithm. Photo electrochemical signaling that optimizes light acclimation and immune defenses in *Arabidopsis* is also defined by a quartic function. We identified molecular regulators that conditionally orchestrate these traits and demonstrated that changes in photo system II maximal photochemical efficiency, water use efficiency, cellular hormonal and reactive oxygen species homeostasis, growth and seed yield of *Arabidopsis*is defined by the quartic function. Therefore, *Arabidopsis* seed yield efficiency is genetically predetermined for optimal or suboptimal conditions. We concluded that *Arabidopsis* plants in the vegetative state could perform sorts of molecular automation that would aim at optimizing the physiological processes, adjust their optimal light absorption, photosynthesis, gas exchange and transpiration in a way similar to that defined by the cellular automation algorithm to reach the best possible acclimation and seed yield in permanently fluctuating environment.

Biography

Prof. Stanislaw Karpinski has completed his Ph.D. from the Swedish University of Agricultural Sci. in Umea, Sweden and did postdoctoral training in John Innes Centre in Norwich, U.K. In 2004 was promoted to the full professor of the Stockholm University and in 2009 the President of the Republic of Poland awarded Karpinski the highest Professor title for the outstanding achievements in biology. He is a member of AAAS, ISFRR and SEB. Presently he is the President of the Plant Oxidative Stress Group of SFRR is a chair and Director of the Centre of the Plant System Biotechnology, Photosynthesis and Renewable Fuels in Warsaw Univ. of Life Sci.