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Specialized metabolic pathways: Cues controlling floral scent and color production

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Odor and pigmentation play a prominent role in the location and selection of flowers by insects and hence in the successful production of farmed foods, as well as in maintaining ecological systems. In terms of commercial appeal, scent and color are also extremely important in the food and floriculture industries. Using virus-induced gene silencing/editing and expression approaches for large-scale identification of floral scent genes, we identified and characterized petunia flower-specific regulatory genes named Emission of Benzenoids (EOBs). Their involvement in the biosynthetic cascade leading to the production/emission of floral scent bouquets was detailed. We further demonstrated that PH4, a *MYB* gene that determines final petal hue through pH homeostasis in the early stages of flower development, is essential for emission, but not production, of the floral volatile bouquet in mature flowers. We also revealed that petunia flowers produce significant amounts of sugar-conjugated scent compounds with a unique diel accumulation pattern that are further catabolized in parallel to scent emission. These phenylpropanoid glycosides are stored in the vacuoles of petunia flowers, providing first evidence of subcellular compartmentalization of scent compounds. We revealed that gibberellin (GA) acts as a developmental cue regulating floral scent production in petunia. GA-dependent timing of the sequential activation of different branches of the phenylpropanoid pathway, products of which are responsible for either color or scent; both necessary for pollinator attraction; may represent an intriguing machinery developed by plants to enable intimate crosstalk between floral pollination syndromes. Integrating knowledge of the structural and regulatory genes involved in floral scent production with the mechanism regulating metabolic flow enabled us to rationally manipulate the pathway toward enhanced production of floral scent compounds and/or pigmentation. Olfactory assay revealed that bees and humans can distinguish the scent of genetically enhanced flowers.

Biography

Alexander Vainstein is the Incumbent of the Wolfson Family Chair in Floriculture and served as a Visiting Professor at USDA and SUNY. He has published more than 140 scientific papers and books, developed 6 patents and has served as the Head of the Hebrew University Graduate Horticulture Program, Graduate Plant Sciences Program and Graduate Biotechnology Program. He was also the Head of The Institute of Plant Sciences and Genetics in Agriculture, Hebrew University of Jerusalem and has served as the President of the Israeli Society of Plant Sciences.

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