Cover Stories:

Major Scientific Publications Featuring NRI-Funded Research

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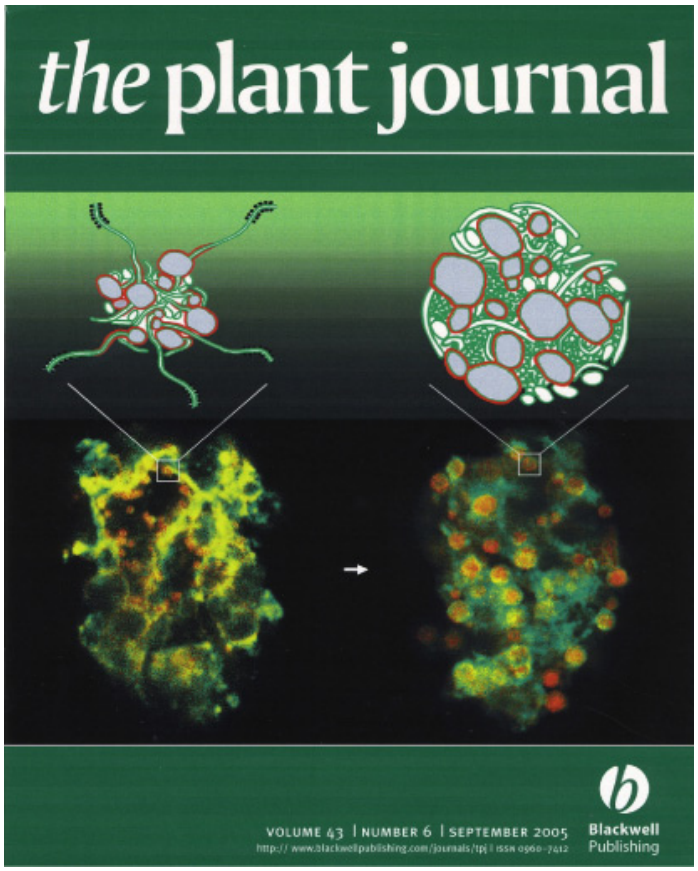
K. Hsieh and A. H. C. Huang. 2005. Lipid-Rich Tapetosomes in Brassica Tapetum Are Composed of Oleosin-Coated Oil Droplets and Vesicles, Both Assembled in and then Detached from the Endoplasmic Reticulum. ***Plant Journal*** 43(6): 889-899.



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Plants produce sexually with the union of male (pollen) and female (eggs) sex cells in flowers. Pollen is synthesized in a small chamber in the stamen, which is enclosed by the tapetum, a layer of metabolically active cells. The tapetum regulates pollen maturation. Many male-sterility genes, such as those used to produce hybrid seeds of corn, oil rape (canola), vegetables, sunflowers, and rice, exert harmful effects in the tapetum, resulting in pollen death. At a late stage of pollen maturation, the tapetum cells accumulate important molecules for deposition on the pollen surface. These molecules include waterproofing lipids, emulsifying proteins (oleosin), signaling proteins that initiate water uptake, and secondary plant products, carrying out many potential functions. Many of these molecules accumulate in abundant organelles called tapetosomes, which are found in the tapetum. In this project, the researchers detailed the structure and biogenesis mechanism of the tapetosomes. A 3-μm tapetosome represents an aggregate of numerous lipid droplets and vesicles. Each lipid droplet has a matrix of lipids enclosed and stabilized by amphipathic phospholipids and oleosin. The droplet is synthesized by budding from the endoplasmic reticulum (ER) within the cell. The vesicles, which are also derived from the ER, contain calreticulin, an ER marker protein, and chemicals from the lumen. The journal cover illustrates immunofluorescence microscopy images of a single tapetum cell. During tapetum cell maturation, oleosin (red) is synthesized in a rough ER network containing calreticulin (green by itself and yellow in the presence of oleosin) and diffuses to and is concentrated at tapetosome-forming centers (red). Each center consists of ER-derived lipid droplets and vesicles and is depicted in a 2-dimensonal model (with lipids shown in light grey). The findings illustrate the function of tapetum cells in nurturing maturing pollen and provide a foundation with which male-sterility and other pollen-controlling genes can be manipulated for enhancement of agricultural productivity.

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