The Stop-and-Go Movement of Golgi Stacks: Illuminating the Dynamic Association between Membranes and Cytoskeleton—Commentary

Nebenführ A, Gallagher LA, Dunahay TG, Frohlick JA, Mazurkiewicz AM, Meehl JB, Staehelin LA (1999) Stop-and-go movements of plant Golgi stacks are mediated by the acto-myosin system. Plant Physiol **121:** 1127–1142

I would like to support the above article for the special issue of *Plant Physiology* dedicated to the celebration of the 25,000th published article. The manuscript by Nebenführ and coworkers demonstrated the movement of plant Golgi bodies along actin filaments and that transport occurs in a "stop-and-go" manner. This means that Golgi bodies can move along actin filaments, but they can also temporarily stop at precise locations in the plant cell. Constant transport guarantees that Golgi bodies are uniformly distributed in the cell, while the stop phase is required for production of vesicles at specific sites, ultimately optimizing trafficking between endoplasmic reticulum (ER) to Golgi and Golgi to cell wall. By fusing GFP to a resident Golgi protein, the authors were able to specifically label and visualize the movement of Golgi stacks in living BY-2 cells. The authors coined the term stop-and-go to describe the movement of the Golgi stacks along actin microfilaments—which is related to cytoplasmic streaming—and stopping of the Golgi on their path. This directed movement was found to be dependent upon actin microfilaments and myosin motors; however, microtubule-disrupting drugs had a small stimulatory effect on organelle streaming. Nebenführ and coworkers suggested a model in which the stop-and-go movement of Golgi units along actin filaments is regulated by stop messages produced by the ER. The stop signals are used to optimize the interaction between Golgi and ER to regulate the trafficking of proteins from membrane compartments to the cell wall. Observation of moving Golgi bodies in the plant cell revealed a phenomenon that had been predicted previously but never described before. As I work in related fields, I found the manuscript of Nebenführ and coworkers fascinating and highly motivating. The possibility to observe Golgi bodies moving along actin filaments in living cells opened enormous avenues of research as well as provided critical information on the dynamic interactions between plant cell organelles and the cytoskeleton, a process that also controls critical aspects of the plant cell (such as shape and growth direction). Following this manuscript, other articles have shown the movement of different organelle classes (such as endosomes and secretory vesicles) in living plant cells. Transport of proteins from ER to Golgi and then to the cell wall matrix is an important process since it is used by plant cells to regulate the secretion of enzymes involved in the synthesis of the cell wall polysaccharides, thus determining the shape and growth direction of the cell. Understanding the molecular mechanism of this process is fundamental for understanding how a plant cell coordinates the cytoskeletal activity with membrane trafficking and cell wall construction.

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www.plantphysiol.org/cgi/doi/10.1104/pp.110.158915