Listening In On the Dialog of Plant Cells

by Robert Sanders

Recent laboratory findings paint a new picture of how plant cells communicate, suggesting that plant cells engage in a sophisticated conversation using a greater variety of proteins and hormones than once thought.

"These findings imply there's a whole lot more communicating than we assumed," says Patricia Zambryski, a professor of plant biology who reviewed the new research in the Dec. 22 issue of Science. Two of the reports appear in the same issue of Science and two in Plant Cell.

Until now a rudimentary form of communication between plant cells was assumed to take place through narrow portals called plasmodesmata, which essentially connect the cells of a plant into one network that allows easy passage of nutrients such as sugars.

Because plasmodesmata appeared too narrow and rigid for any but the smallest molecules to traverse, cell-to-cell signaling was thought to be mediated by small molecules only--growth hormones and small proteins called peptides.

Instead, plasmodesmata now appear to be flexible conduits that, at the proper signal, expand to allow large molecules through. Moreover, these large molecules appear to use the cell's skeleton, the cytoskeleton, as a highway to and from the plasmodesmata.

"It's a totally new concept," says Bill Lucas, a professor of plant biology at UC Davis and coauthor of a research paper on the subject in the same issue of Science. "We plant scientists had no idea that plants had the capacity to traffic their own proteins from cell to cell. This sets in place a whole new way of understanding how plants control the development and fate of cells during tissue growth."

How protein trafficking works is still far from understood, but the fact that it exists has broad implications for agriculture, biotechnology and nutrition, and for understanding plant evolution, Lucas says.

For example, understanding the transport of proteins to and through the plasmodesmata could help scientists devise ways to stop the spread of viruses.

The revised picture of plant cell communication has emerged primarily from four separate California laboratories, all of them taking their lead from plant viruses, which are known to wander through plants via the plasmodesmata.

The Zambryski lab at Berkeley was the first to produce biochemically purified viral movement protein with the aim of studying its function. She and her colleagues discovered that viral movement proteins are tenacious single strand proteins that bind to nucleic acid, the stuff from which the genetic material DNA is made. This finding provided a rationale for how movement proteins promote spread of viral genetic material.