Discovery outlines basic communication inside cells

by Todd Mockler

CORVALLIS, Ore. â€“ Researchers at Oregon State University have made an important fundamental discovery about how different components of plant cells communicate with each other to allow for proper cell and life functions.

The findings, just published in the journal Science, identify a gene involved in plant stress responses that also has a duel role in communication between the chloroplast and nucleus of cells. The correct function of this process is integral to plant function and the process of photosynthesis, which forms the basis for much of the life on Earth.

â€œThereâ€™s a great deal we still do not understand about basic cellular function in plants and animals,â€• said Todd Mockler, an assistant professor of botany and plant pathology at OSU. â€œA lot of people donâ€™t realize that. But every advance of this type gives us a better understanding of what is going on in the processes of life and living cells, in this case how one part of a cell communicates and interacts with another part.â€•

The discovery was made possible, Mockler said, by applying DNA â€œmicroarraysâ€• to a biological problem, and then using advanced computational algorithms for the analysis of the DNA sequences that control when and where genes are turned on, or â€œexpressed.â€• This is one of the key tools that has so far emerged from the Computational and Genome Biology Initiative, a major emphasis of the university in recent years.

â€œWeâ€™re already making this technology freely available to scientists anywhere in the world to speed up their own studies on biological function,â€• Mockler said. â€œThey can go on the web at http://www.cgrb.oregonstate.edu and find powerful tools available for bioinformatics research. We anticipate that these tools should be widely used, because the underlying approaches are equally relevant to any life form, whether itâ€™s a plant, yeast, worm, mice or humans.â€•

Chloroplasts in plants are one type of organelle â€“ almost like a cell within a cell â€“ that has its own DNA, is a relic of evolution from billions of years ago, and plays a major role in cell function. In plants, chloroplasts are the control center for photosynthesis.

â€œThe communication between the chloroplast and other parts of the cell is like a sophisticated orchestra,â€• Mockler said. â€œWe understand the general process but weâ€™ve never really figured out the details of how the communication actually takes place, what molecules and proteins are involved. Now weâ€™ve identified a couple more components, an improved understanding of the process.â€•

In this study, the scientists used mutant plants to help track down the genes that controlled at least part of this communication process. They found one gene involved, ABI4, that was previously known to be part of a plantâ€™s response to stresses such as cold or drought. Surprisingly, it also played a role in the communication process between the chloroplast and plant nucleus.

â€œBut when we thought about it, it also made sense that a gene which was essential to stress response might also play a role in cellular communication,â€• Mockler said. â€œBoth are essential processes to the survival of the plant. This helps tie together several plant functions.â€•

Collaborating in this research were scientists from the Howard Hughes Medical Institute, the Salk Institute for Biological Studies, and the University of Nevada.

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