Computational Simulation And Experimental Control Of Polarized Growth In Trichoblast Cells In The Plant Shoot

Researchers identified a protein complex that controls cell wall properties and tip-refinement genes in cotton, offering better control over fiber elongation and potentially boosting the value of cotton fibers.

Fibers and fabrics, such as cotton, are used extensively in today's society. The value of a cotton fiber is determined by its length and strength, which can be affected by how quickly they are refined as long, thin fibers. Currently, the cellular and molecular control of this refinement is unknown and there is little genetic diversity among cotton plants; therefore, genetic engineering would greatly improve the value of cotton. At present, various labs are searching for factors that can affect fiber elongation, using gene silencing or inhibitor treatments, but there is no real understanding of the growth process. Hence, there is a need to find a method to control factors, such as cell wall thickness, cell wall anisotropy, and cell wall composition, in these plants.

In search for such a process, agricultural researchers at Purdue University have found a set of protein complexes that can alter plant growth. Using a combination of live cell imaging and computer models of plant leaves, they determined how actin and microtubule cytoskeletons work together to change the cell wall and plant growth. The actin-related protein (ARP) 2/3 complex makes an actin meshwork that acts in a specific zone to modify cell wall anisotropy. This also promotes branch elongation and maintains cell wall thickness that would allow growth of the tip in a certain direction. This genetically engineered cytoskeletal protein is important because it identifies properties of the cell wall that can help with tip refining for cotton fiber elongation, it creates a model that can demonstrate growth patterns of plants for experimental purposes, and it has helped identify 14 genes that control the tip refinement process. This technology can be used in other elongation strategies for different types of plants and help boost the value of cotton fibers in the cotton industry.

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Category
Agriculture, Nutrition, & AgTech/Crop Genetics & Breeding
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Advantages:

-Better control of cotton refinement

-Model protein that shows growth patterns

-Identified 14 genes for research into plants

Potential Applications:

-Agricultural efficiency

-Farming tools

TRL: 3

Intellectual Property:

Provisional-Patent, 2015-02-03, United States | Utility Patent, 2016-02-03, United States

Keywords: cotton fiber elongation, genetic engineering, actin-related protein, ARP 2/3 complex, cell wall anisotropy, plant growth, cytoskeletons, fiber refinement, agricultural efficiency, plant genetic diversity, Agriculture, Cell Growth, Genetics, Plant Genetics