Adjustable valves gave ancient plants the edge

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Controlling water loss is an important ability for modern land plants as it helps them thrive in changing environments. New research from the University of Bristol, published today in the journal *Current Biology*, shows that water conserving innovations occurred very early in plants' evolutionary history.

The research focused on the role of stomata, microscopic pores in the surface of leaves that allow carbon dioxide gas to be taken up for use in photosynthesis, while at the same time allowing water to escape. Instead of being fixed pores in the leaf, rather like a sieve, the stomata of modern plants are more like valves that open and close on demand. They do this in response to environmental and chemical signals, such as light and carbon dioxide, therefore balancing the photosynthetic and water requirements of the plant. Therefore, a key evolutionary question is: when did plants develop these 'active' mechanisms of stomatal control?

Elizabeth Ruszala, a Gatsby Charitable Foundation-funded PhD student working in Professor Alistair Hetherington's research group in the School of Biological Sciences, studied the stomata of *Selaginella uncinata*, a member of a primitive group of plants called spikemosses, which first appeared approximately 400 million years ago.

Significantly, not only were the stomata of this ancient group of land plants able to open and close in response to changes in light and carbon dioxide, they also responded to the key plant hormone abscisic acid which regulates stomatal function – especially under drought conditions

– in modern plants.

These results show that the ability to regulate stomatal aperture in response to changing environmental conditions was already present very early in plant evolution.

Research on understanding how stomata work is also directly relevant to the agriculture needs of the twenty-first century because a key target for crop breeders is the development of new varieties that produce excellent yields but use less water in the process.

Professor Alistair Hetherington said: "Understanding how plants made the successful transition from life in water to the successful colonization of the drying terrestrial environment is one of the big questions in contemporary plant biology. Our work shows that the acquisition of stomata that were able to open and close in response to changing environmental conditions, thereby helping plants to avoid drying out, was a very important step in the evolution of the land flora."

Provided by University of Bristol