

Project 13. Counting stomata cell structure in plant leaves.

Leaves are the photosynthetic organs of plants. Stomata are specialized cells that can open and close on the surface of leaves, to allow carbon dioxide into the leaf for photosynthesis, or can close to prevent water loss when conditions are hot and dry. Leaf shape and stomata density/size/patterning play major roles in determining how fast a plant can grow and how it will be affected by environmental conditions, such as drought.

We are studying how leaf shape and stomata properties are genetically controlled in poplar trees, and in turn how these traits influence how the trees grow. We have a large collection of leaf and stomata images from poplar trees that have been genomically characterized for DNA chromosomal variation. We are examining the effect of genetic (DNA sequence) variation at specific regions of the genome to leaf shape/size and stomata density/size/patterning, to ultimately understand how these traits are genetically regulated.

The challenge is to create new tools that 1) analyze leaf shape, with output including quantification of shape for each image, 2) analyze leaf size, including surface area, maximum width, height, and 3) analyze the density, size and patterning of stomata on leaf surfaces.