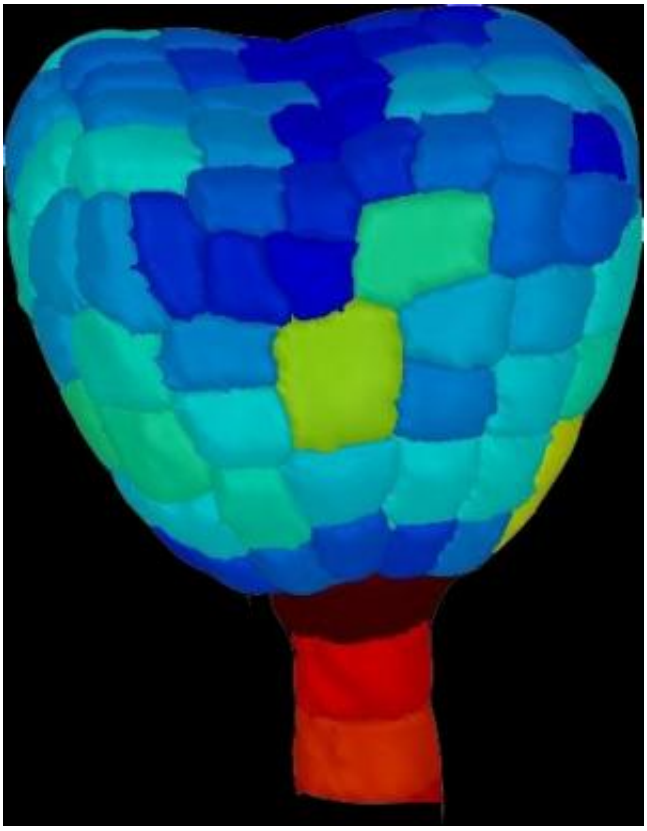
Hormone causes dividing plant cell to rebel

March 28 2014, by Prof.dr. D (Dolf) Weijers



An embryo showing the two cotyledons (seed leaves) starting to develop at the top. Cells are coloured according to a colour scale whereby large volumes are shown in red and small volumes in blue.

Cell division in plants is governed by a physical law. A law that was postulated in the 19th century and tested in a two-dimensional plane many times after that. In an article published in the top journal *Developmental Cell* on 27 March, researchers from Wageningen

University show that the law applies equally in 3D. However, the plant hormone auxin then breaks this law, steering growth to generate the organised plants we all know and love.

Plants grow because cells divide. Biologists have been observing the patterns of cell division ever since the invention of the microscope. In the second half of the 19th century, the patterns scientists observed inspired them to formulate simple 'rules' that explained the patterns of cell division. Perhaps the most famous rule is the one formulated by Leo Errera in 1888, which dictates that plant cells divide like soap bubbles. They take the shortest path by forming a partition straight across the middle of the cell. The shape of the cell (the geometry) therefore determines the new division plane.

Plant embryo development in 3D

Although rules like this are commonly applied (in simulation models for plant growth, for example), until now they have only ever been tested in the two dimensions that make up the flat plane. In a study carried out in the Laboratory of Biochemistry, Wageningen researcher Professor Dolf Weijers and his team accurately imaged very young plant embryos in three dimensions. They did this by refining an existing 3D method for analysing plant embryos. The simulation models subsequently developed can be used to prove whether cells divide according to the 'shortest path' principle or not.

Flouting the rules

"Some divisions certainly follow this standard rule", explains Dolf Weijers, "but others do not!" The researchers discovered that cell divisions that deviate from this norm always result in two different types of cells. "It is an asymmetric division", he continues. "But to our

surprise, these divisions turned out to be controlled by a plant hormone; the auxin hormone." When the researchers deactivated this hormone, all the cells suddenly divided according to the standard rule. The research team therefore concluded that the hormone auxin enables cells to ignore the standard rule.

These findings shed new light on the function and effect of the important hormone auxin in the development of plants. "The main question is how the hormone manages to make the cells rebel in this way", says Weijers. "Although we have not answered this question yet, at least we now know that there is a question to answer".

Controlling cell division is an important first step in the development of new organs in plants. The researchers hope that learning more about how this process works will help them to devise new strategies for advancing plant growth.

Provided by Wageningen University