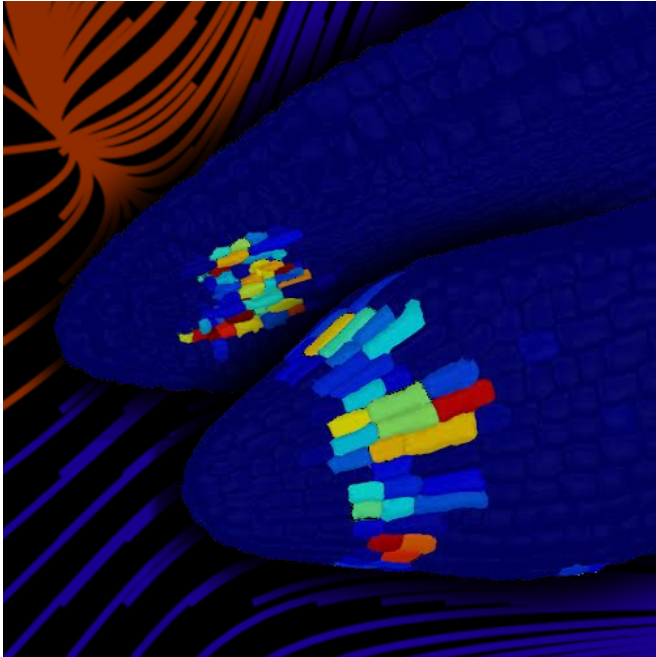


Scientists discover plant 'brain' controlling seed development

5 June 2017



A 3-D digital reconstruction of a plant embryo, showing location of decision-making components, on a mathematically-modelled background. Credit: University of Birmingham

A new study by scientists at the University of Birmingham has revealed a group of cells that function as a 'brain' for plant embryos, capable of assessing environmental conditions and dictating when seeds will germinate.

A plant's decision about when to germinate is one of the most important it will make during its life. Too soon, and the plant may be damaged by harsh winter conditions; too late, and it may be out-competed by other, more precocious plants.

In a study published today in *Proceedings of the National Academy of Sciences (PNAS)*, scientists from the University of Birmingham have shown that this trade-off between speed and accuracy is

controlled by a small group of [cells](#) within the [plant embryo](#) that operate in similar way to the human brain.

The scientists showed that the 'decision-making centre' in a plant called Arabidopsis, or thale cress, contains two types of cell - one that promotes seed dormancy, and one that promotes germination. These two groups of cells communicate with each other by moving hormones, an analogous mechanism to that employed by our own brains when we decide whether or not to move.

The scientists used mathematical modelling to show that communication between the separated elements controls the plant's sensitivity to its environment. Following this theory, they used a mutant plant where cells were more chemically linked - essentially enhancing communication between circuit elements - to show that germination timing depends on these intra-region signals.

Lead author of the study, Professor George Bassel from the School of Biosciences at the University of Birmingham, says:

'Our work reveals a crucial separation between the components within a plant decision-making centre. In the [human brain](#), this separation is thought to introduce a time delay, smoothing out noisy signals from the environment and increasing the accuracy with which we make decisions. The separation of these parts in the seed 'brain' also appears to be central to how it functions.'

Dr Iain Johnston, a University of Birmingham biomathematician involved in the study, adds:

'The separation of [circuit elements](#) allows a wider palette of responses to environmental stimuli. It's like the difference between reading one critic's review of a film four times over, or amalgamating four different critics' views before deciding to go to the cinema.'

The mathematical theory describing the brain's function predicted that more seeds would germinate when exposed to varying environments, such as fluctuating temperatures, than to constant environments. The scientists tested this theory in the lab and found exactly this behaviour.

'Our work has important implications for understanding how crops and weeds grow,' adds Prof Bassel.

'There is now potential to apply this knowledge to commercial [plants](#) in order to enhance and synchronise germination, increasing crop yields and decreasing herbicide use.'

More information: Alexander T. Topham et al., "Temperature variability is integrated by a spatially embedded decision-making center to break dormancy in Arabidopsis seeds," *PNAS* (2017). www.pnas.org/cgi/doi/10.1073/pnas.1704745114

Provided by University of Birmingham

APA citation: Scientists discover plant 'brain' controlling seed development (2017, June 5) retrieved 12 May 2021 from <https://phys.org/news/2017-06-scientists-brain-seed.html>

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