Researchers disprove the assumption that parents conflict with one another during a plant's embryonic development

May 8 2017

Researchers disprove the assumption that parents conflict with one another during a plant's embryonic development. Credit: Thomas Kunz

The *Arabidopsis thaliana* is a tiny, inconspicuous and herbaceous offshoot of the family of cruciferous plant that one might easily overlook in a meadow, yet the plant has the potential to disrupt a common school of thought: Together with his working group and colleagues from the University of Nagoya, Japan, the Freiburg biologist Prof. Dr. Thomas Laux show how plants start embryo development and thereby follow a fundamentally different reproduction strategy than animals. The team used the *Arabidopsis thaliana* as a model organism and showed how plants begin with gene transcription, that is genome reading, just hours after fertilization. That includes the genes that regulate the first steps in embryonic development. The researchers describe the newly found mechanism in the scientific journal *Genes and Development*.

From a biological standpoint, life begins after fertilization: The organism has a gene expression program that regulates embryonic development from a single zygote—that is, from the fusion of an egg cell and a sperm. In mammals, this new start occurs almost without any transcription in the zygote and rather uses gene transcripts and proteins that have been stored by the mother in the egg cell. Plants, however, have chosen a different strategy to ensure the transcription of the correct genes in the zygote: an intracellular signal pathway, activated by the sperm, adds phosphate residues to the transcription factor WRKY2 and ensures communication between the cell membrane and nucleus. As a consequence, this protein is enabled to activate the transcription of a master regulator, named WOX8, which controls the first steps of embryogenesis. In the case of

the *Arabidopsis thaliana*, it includes, for instance, the formation of the shoot-root axis and the cell divisions that give rise to plant growth.

Nonetheless, WRKY2 alone cannot completely regulate the WOX8 transcription. It requires the help of additional transcription factors stemming from the maternal genes called HDG11 and HDG12. Only the combination of the sperm-activated WRKY2 and the maternally provided HDG proteins guarantees that the embryo regulation begins in the zygote. One obvious advantage of this collaboration is that the embryogenesis program is only activated when the egg cell and sperm fuse.

The study stands in contrast to the long-standing so-called "parental conflict theory" that has been proposed for plants and mammals: This theory holds that for embryonic nourishment the two parents act antagonistically. Whereas paternal gene copies favor nutrient supply to only their own offspring, the maternal gene copies tend to favor the distribution of resources among all offspring. The findings of the research group suggest that one must assume a new model for the initiation of embryonic development of plants that relies on both parents' cooperation.

More information: Ueda, M., Aichinger, E., Gong, W., Groot, E., Verstraeten, I., Dai Vu, L., De Smet, I., Higashiyama, T., Umeda, M. and Laux, T. (2017). Transcriptional integration of paternal and maternal factors in the Arabidopsis zygote. *Genes and Development* 31, S. 617-662.

Provided by University of Freiburg

plant's embryonic development (2017, May 8) retrieved 12 May 2024 from https://phys.org/news/2017-05-assumption-parents-conflict-embryonic.html