Press Release

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No sex required

German-Israeli team discovers gene trigger for asexual reproduction

When a sperm and an egg cell merge a new life begins. This is the case in humans and in animals, but in principle also in plants. A German-Israeli team led by the biologists Professor **Ralf Reski** from Freiburg and Professor **Nir Ohad** from Tel-Aviv has discovered a gene trigger in the moss *Physcomitrella patens* which leads to offspring without fertilization. The researchers assume that this mechanism is conserved in evolution and holds the key to answer fundamental questions in biology. The study is published in the journal “Nature Plants”.

„Just like humans and animals, mosses possess egg cells and motile sperm. That is why they are particularly well-suited to answer fundamental questions in biology”, Reski says. After fusion of sperm and egg cell, a network of genes is activated. That leads to the development of an embryo which grows into a new living being. Until now it was unclear whether a central genetic switch for this gene activation exists. In their latest publication the team describes the gene BELL1 as a master regulator for the formation of embryos and their development in *Physcomitrella*. After the researchers activated this gene in the plants by genetic engineering, embryos developed spontaneously on a specific cell type. These embryos grew to fully functional moss sporophytes. These spore capsules could even form spores, which grew into new moss plants. Thus, the team identified BELL1 as a master regulator for embryo development in mosses.

The protein encoded by this gene belongs to the class of so-called homeobox transcription factors. Similar homeotic genes are also present in humans and animals, where they also control pivotal developmental processes. Whether a congener of BELL1 is a master regulator of embryo development in humans is not yet known. “Our results are important beyond mosses”, Reski says. “On the one hand they can explain how algae developed into land plants and thus shaped our current ecosystems. Secondly, they may help to revive the concept of genetic master regulators in the development of plants, animals and humans.” Ohad explains, “Moreover, our results may help to modernize agriculture through the creation of genetically identical offspring from high-yielding crop plants. In seed plants such offsprings are formed by parthenogenesis or apomixis.”

Ralf Reski from the University of Freiburg is a specialist in moss research and has helped to develop *Physcomitrella* as a model organism for biology and biotechnology at a world-wide scale. Nir Ohad from Tel-Aviv University is a specialist in the epigenetic regulation of reproductive development. He helped to identify the first BELL genes in seed plants about 20 years ago as member of a team led by Professor Robert Fischer from UC Berkeley. Research was supported by the German-Israeli Foundation GIF, the Freiburg Excellence Cluster BIOSS and the Freiburg Institute for Advanced Studies.

Ralf Reski heads the Chair of Plant Biotechnology at the University of Freiburg. The biologist is a member of the Cluster of Excellence BIOSS - Centre for Biological Signalling Studies and was Senior Fellow at FRIAS, the Freiburg Institute for Advanced Studies of the University of Freiburg and at USIAS, the University of Strasbourg Institute for Advanced Study, France.
Nir Ohad is the Director of the Manna Center Program for Food Safety & Security at Tel-Aviv University and a member of the Department of Molecular Biology and Ecology of Plants at the Faculty of Life Sciences in Tel-Aviv University. He was a Visiting Fellow at the Freiburg Institute for Advanced Studies.

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Original Publication:

Nelly A. Horst, Aviva Katz, Idan Pereman, Eva L. Decker, Nir Ohad, Ralf Reski (2016): A single homeobox gene triggers phase transition, embryogenesis, and asexual reproduction. *Nature Plants*, DOI: 10.1038/nplants.2015.209.

Figure legend: *Physcomitrella patens* moss plantlet with a spore capsule (Photo: Nelly Horst, Plant Biotechnology Freiburg).

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