



Calcium ions encode information

Biologists from Freiburg (Germany) and Plymouth (UK) have discovered an important building block for plant signalling pathways - publication in PNAS

When plants experience environmental stress, they adapt to their new surroundings. This important information is passed on to their nuclei using signalling systems that use calcium ions as important messengers.

Biologists from the **University of Freiburg, Germany**, and the **Marine Biological Association of the UK** have discovered a protein that is involved in the rapid transfer of information to the nucleus. Their findings are presented in the current version of the highly regarded Proceedings of the National Academy of Sciences of the USA (PNAS).

Today the effects of global climate change are becoming more and more apparent, as seen in the extremes experienced regularly by many through storms, floods and drought. At the same time intensive agricultural methods have led to the salinisation of vast areas of farmland. These environmental changes may be particularly stressful for certain organisms, particularly for plants which have no obvious means of escape. To counteract this plants have developed sophisticated mechanisms to protect themselves in stressful situations. In order to activate these protective mechanisms plants need to be able to detect changes such as increased levels of salt concentration in the soil and pass this information on to their cell nucleus - their genetic control centre - as quickly as possible via signalling pathways. It has been known for a while that calcium ions play an important part in signal transduction in plants as well as in animals. Levels of calcium ions can change very quickly within the cells and these rhythmical changes may occur in particular patterns that encode this information.

Together with British researchers biologists at the University of Freiburg have reported their findings on the discovery of a protein, a so called Ca^{2+} -ATPase, which is central to fast signal transduction, in the moss *Physcomitrella patens* in the current online version of PNAS.

The title of the publication is "A $\text{P}_{11\text{B}}$ -type Ca^{2+} -ATPase is essential for stress adaptation in *Physcomitrella patens*" (PNAS 105, 19554-19559). As well as **Dr. Wolfgang Frank** and **Prof. Ralf Reski**, **Enas Qudeimat**, **Dr. Alexander M.C. Faltusz**, **Dr. Glen Wheeler**, **Daniel Lang**, **Prof. Colin Brownlee** were also involved in the project. After a so called calcium "spike" the Ca^{2+} -ATPase protein pumps excess calcium ions from the cytoplasm into the small vacuoles - the storage tanks - of the moss cells.

Ihre Ansprechpartner:

Rudolf-Werner Dreier (Leiter)
Eva Opitz
Dr. Eva Maria Wagner
Claudia Wasmer
Melanie Hübner
Lisa Heiny

These cell organelles are different from the already familiar central vacuoles and were only recently discovered. Initially their function was not understood. This means the newly discovered plant-based calcium ATPase is central to the formation of calcium patterns in the cell. Mutant moss plants which had this protein switched off were not able to survive in high salinity.

The researchers at the University of Freiburg now hope that this knowledge can be put to use on crops, making them less susceptible in soil with high salinity; an ever-increasing problem, particularly in Third World countries.

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Contact:

Prof. Dr. Ralf Reski
PD Dr. Wolfgang Frank
Chair Plant Biotechnology
University of Freiburg
Tel.: 0049 (0)761/203-6968
Fax: 0049 (0)761/203-6967
Email: pbt@biologie.uni-freiburg.de
www.plant-biotech.net