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Microfluidic monitoring of programmed cell death in living plant seed tissue

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Programmed cell death (PCD) is a highly regulated process in which cells are dismantled. Reactive oxygen species (ROS) are involved in PCD in plants, but the relationship between and mechanisms behind ROS and PCD are only poorly understood in plant cells compared to in animal cells (Gechev, Tsanko, et al., (2006), BioEssays, 28, p. 1091).

Microfluidic cell culture enables *in vitro* experiments to approach *in vivo* conditions. Combining microfluidics with the Lab-On-a-Chip concept allows implementing a wide range of assays for real-time monitoring of effects in a biological system of factors such as concentration of selected compounds, external pH, oxygen consumption, redox state and cell viability.

The aleurone layer of the barley seed is a 2-3 single cell type thick tissue that can be dissected from the embryo and starchy endosperm. During incubation *in vitro* this mechanically very robust maintains highly specific responses to the phytohormones gibberellic acid and abscisic acid. Combined with the increasing usage as a model for studying plant protein secretion, these properties make the aleurone layer ideal for maintenance in a microfluidics system (Fath, Angelika, et al., (2001), Plant Physiol, 126, p. 156; Finnie, Christine, et al., (2011), Proteomics, 11, p. 1595).

The potential of microfluidics real-time monitoring is relatively unexplored within plant biology, and the barley aleurone layer system will thus enable new ground to be broken in the field of plant science and microfluidics.

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