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Actin Filaments in Guard Cells Change Dynamically during Stomatal Movements and Modulate K^+ Channel Opening Probabilities.

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Stomatal movements involve pronounced changes in the shape and volume of the guard cells. Recently we visualized radially distributed cortical actin filaments in mature guard cells and using the whole cell patch clamp technique, demonstrated that the actin filaments modulate the K^+ currents. We now report that the structure of actin filaments changes during normal stomatal movements and the effects of actin antagonists on the activities of K^+ currents are confirmed at the single channel level. The epidermal tissue of *Commelina communis* was immunostained with anti-actin antibody. In guard cells of stomata open under bright light, cortical actin filaments distributed along the entire circumference of the cell. However, in guard cells of stomata closed under darkness, either short filaments close to the stomatal pore site or longitudinal thick subcortical filaments were observed. The effects of actin antagonists on single K^+ channel activities in the outside out membrane patches were investigated. Cytochalasin D enhanced the opening probability (P_o) of the inward K^+ channel and decreased P_o of the outward K^+ channel. In contrast, phalloidin inhibited the P_o of the outward K^+ channel. We propose that the structure of actin filaments changes dynamically during normal stomatal movements and it contributes to the movements by modulating K^+ channel activities.

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Involvement of Oxygen Radicals in the Low-Temperature Photoinhibition of Photosystem I

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To investigate the inhibitory mechanism of light-chilling in photosystem (PS) I, the PSI activity of chilling-sensitive cucumber leaf discs was compared with that of chilling-resistant spinach leaf discs. A 45% reduction in the PSI activity of isolated thylakoids was observed in cucumber leaf discs chilled at 4℃ for 8 h under 50 μ mol·m^{-2}·s^{-1} compared with the unchilled control plants. In spinach, the same light-chilling did not cause any changes in PSI activities. However, when the isolated thylakoid suspensions were light-chilled, PSI activities of both plants were damaged. These results suggest that there is some mechanisms that protect PSI in chilling-resistant plants, which can not function in isolated thylakoids. To test the possible involvement of superoxide dismutase (SOD) in the protection of PSI, spinach leaf discs were infiltrated with 100 mM of a SOD inhibitor, diethyldithiocarbamate (DDC), for 30 min in the dark at 25℃. The leaf discs were then light-chilled for 90 min. By the inhibition of SOD, the PSI activity in spinach were reduced by 11% compared with the DDC-untreated control. The PSII activity was not decreased by this treatment. These results suggest that oxygen radicals are involed in the low-temperature photoinhibition and their inhibitory effects are protected by SOD in chilling-resistant spinach.