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Opinion Article

Role of Nuclear Casings during Retrograde Signaling by H_2O_2 Injections

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DESCRIPTION

Chloroplast nucleus (retrograde) signaling is an important part of the plant's ability to recognize and respond to changes in the environment, especially those that require final regulation of photosynthetic capacity. The ability to regulate immediate and long-term responses to environmental perturbations occurs at the cellular, tissue, and systemic levels [1]. A particularly active area within this area of study is the quest to identify the exact signaling pathway between the chloroplast and the cell nucleus. Several signaling pathways and signal triggers and transducers have been identified and continue to attract attention, but there are undoubtedly more discoveries. The close association between some of the cell's chloroplast supplement and its nucleus is characteristic of all plant species. Recently, juxtaposition of chloroplast subsets with the nucleus has been proposed to be an important feature in the transmission and coordination of highly complex processes between these organelles in response to developmental and environmental cues. Because of this, relationship is getting more and more consideration. Since some signaling molecules can be derived from multiple cell sources, a close association between the nucleus and a subset of chloroplasts may provide the specificity required for retrograde signaling. Conversely, if the origins of such molecules are not distinguished, their use as signaling agents from chloroplasts does not provide specificity. This discussion is most relevant, and the molecule used as an example in this review is Hydrogen Peroxide (H_2O_2), whose origin produces different patterns of gene expression from different intracellular sources and associated signals. It means that it has transmission specificity [2]. Observations suggest that H_2O_2 may also be a transduction signal from the chloroplast to the cell nucleus. In higher plants, the movement of H_2O_2 between the chloroplast and the nucleus was studied in the epidermal cells of *Nicotiana benthamiana* tobacco (Nb). This tissue can be easily accommodated using a confocal laser scanning microscope to monitor changes in the oxidative state of transiently expressed and genetically encoded H_2O_2 reported fluorescent biosensor proteins, significant for interpreting the response to some environmental stresses is that the Nb patch cells in the epidermis are photosynthetic. H_2O_2, which accumulates in Nb chloroplasts in these studies, occurs in response to increased light intensity or pathogen effector induced immunity. However, various environmental issues change H_2O_2 levels in other intracellular compartments such as peroxisomes, mitochondria, cytosols, and plasma membranes. Therefore, it is suggested that the association of chloroplast nuclei is involved to determine how H_2O_2 secreted by chloroplasts is specific for the transmission of oxidative signals to the nucleus.

Stromules

Stromule formation may be associated with suppression of photosynthesis occurring in Arabidopsis thaliana attacked by elicitors. Photo inhibition is also an important step in stimulating stromule formation in the absence of pathogen infection senescing leaves. Stromules appear to promote contact between chloroplasts to chloroplasts, but they also appear to promote contact with chloroplast nuclei, a channel through which H_2O_2 and selected proteins are transmitted to the nucleus although, this is still being discussed.

Nuclear envelope

The outer membrane of the nuclear envelope is continuous with the Endoplasmic Reticulum (ER) membrane, resulting in a 50 nm wide pronuclear space between the inner and outer nuclear envelopes adjacent to the ER lumen. Chloroplasts, like many other organelles that form physical interactions with the ER, usually attach to the outside of the ER or nuclear envelope at a distance of 10 nm-30 nm. Therefore, the ER outer membrane is often very closely associated with the chloroplast outer membrane [3]. A long-observed phenomenon is the avoidance response of chloroplasts, which is controlled by phototropism and move away from the high fluency blue light that induces movement using the actin cytoskeleton. Interestingly, nuclei that cannot move independently are pulled by the attached chloroplasts. Undoubtedly, many proteins are involved in the binding of chloroplasts to the cell nucleus and their rearrangement within the cell, as well as other functions such as plastid fixation to the plasma membrane and chloroplast division.

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H_2O_2, Aquaporins (AQPs and the route to the nucleus

The evolution of H_2O_2 across the membrane is thought to be caused by dispersion along a concentration gradient manipulated by layer-specific proteins. Nevertheless, the diffusion of H_2O_2 from AQP into red platelets has not yet been processed by the ambiguous layered protein or lipid portion, so it may be an autonomous method of AQP for transporting H_2O_2 between intracellular compartments. This is true, despite the physicochemical consideration that the direct dispersion of H_2O_2 across the layer can be discarded. If all other conditions are the same, all AQPs that transport H_2O can also transport H_2O_2, despite differences in the productivity of how individual AQP isoforms separate between these two atoms [4]. The possibility of very close contact between the chloroplast envelope and the outer nuclear envelope may be reminiscent of the limited and extensive fixation of the micro-domain in or near the MCS, with additional AQP on the outer nuclear envelope. Assuming they are in close proximity, this works with the exchange of H_2O_2 in the pronuclear space. Animal cell mitochondrial MCS creates an environment in which H_2O_2 is truly concentrated in the micro-domains on one or the other side of the mitochondrial envelope. This suggests that there may be an outer nucleus or ER layer that resembles chloroplasts, and that H_2O_2 micro-domains have certainly been identified in relation to epidermal Nb chloroplasts.

CONCLUSION

One can visualize two chat situations: (a) expanded H_2O_2 from the ER lumen enlarging H_2O_2 coming from chloroplasts and intensifying a pressure responsive sign; or the inverse: (b) the construction of a retrograde sign now by expanded and exceptionally restricted cell reinforcement movement. This could give a method for mediating retrograde signaling to fit a harvest plant's reaction to natural pressure. This might end up being a simpler choice than attempting to control a H_2O_2 signal whenever it has shown up in the core considering the exchange of oxidizing counterparts is reasonable through a broad and profoundly portable organization of intermediate redox transporters to plenty of beneficiary redox-sensitive administrative proteins.

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