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From Duckweed Stress Physiology to D-Amino Acid Signaling: Insights Across Biological Kingdoms

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Edna Ben-Izhak Monselise Department of Life Science, Bergmann Campus, Ben-Gurion University of the Negev, Beer-Sheva 8441901, Israel bened@post.bgu.ac.il Cellular stress responses involve extensive metabolic reprogramming. While alterations in amino acid concentrations under stress have been widely documented, the potential role of amino acid chirality in stress adaptation remains poorly understood. Using ^{15}N NMR spectroscopy, stress-dependent changes in amino acid profiles were investigated in aquatic plant systems, *Landoltia punctata*. These studies revealed the appearance of D-alanine under defined stress conditions (Monselise et al., 2015), providing evidence for stress-associated D-alanine accumulation in duckweed and suggesting that stereochemical remodeling may represent a component of the plant stress response. Subsequent studies in *Escherichia coli** demonstrated stress-associated production and extracellular release of D-glutamate (Monselise, 2019; Monselise 2024). The release of D-glutamate into the surrounding medium suggests that stress-induced D-amino acids may function beyond intracellular metabolism and participate in intercellular biochemical communication. Taken together, these observations from both plant and bacterial systems raise the possibility that D-amino acids constitute conserved elements of stress-response networks across biological kingdoms. These findings support a broader conceptual framework in which stress-induced stereochemical changes contribute to cellular adaptation and signaling. The presentation will discuss the evolution of this research, from duckweed stress physiology to broader questions concerning the role of D-amino acids in cellular stress responses and their possible relevance to the early stages of cellular dysfunction.

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References

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