BIOSYNTHESIS OF *N*-ACYLPHOSPHATIDYLETHANOLAMINE IN GERMINATING COTTONSEEDS

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Abstract

N-Acylphosphatidylethanolamine (NAPE) is an unusual acylated derivative of the common membrane phospholipid-- phosphatidylethanolamine (PE). Because of its bilayer stabilizing properties [1], it has been proposed to play a role in the maintenance of cellular compartmentation during tissue damage in some animal systems [2]. In this presentation, the identification, quantification, and biosynthesis of NAPE in cottonseeds are described. NAPE was purified from cottonseed lipid extracts by 2-dimensional TLC and identified by mass spectrometry. The molecular species of NAPE in cottonseeds that were identified by mass spectrometry were consistent with structures deduced by gas chromatographic analyses of NAPE hydrolysis products. Palmitic (16:0) and linoleic (18:2) acids were most prevalent at the *N*-acyl position of cottonseed NAPE. NAPE content and biosynthetic capacity in cotyledons increased during seed imbibition/ germination and then declined during postgerminative growth. The decline in NAPE synthase (enzyme which synthesizes NAPE from PE and free fatty acids) activity preceded the decline in NAPE content and was more pronounced in the light. Maximum biosynthetic capactiy of NAPE in cotyledons appeared to coincide with seed germination, reproducibly highest 12 h after commencing imbibition. NAPE synthase activity was present in cotyledons of developing cotton embryos, but at 10-fold lower levels (on a per seed basis) than in germinating seeds. Seeds of other plants (including okra, corn, watermelon, pea, sunflower, oat, and peanut) were surveyed for their ability to synthesize NAPE. Generally, there was an inverse linear relationship ($r^2 = 0.87$) between NAPE synthase specific activity in dry seeds and the time required for seed germination (radicle emergence). Because NAPE is synthesized in cottonseed membranes by a direct acylation of PE with free fatty acids, we have postulated that NAPE synthase serves to scavenge free fatty acids released in intracellular membranes, and as a consequence, protects cells from loss of compartmentation. Loss of desiccation tolerance (manifested in seeds poor viability) is attributed to, among other things, increased levels of free fatty acids [3]. Continued studies of NAPE synthesis at the molecular level are planned to determine its precise physiological function.

References

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