castor bean leaf discs, suggesting that gene activation and protein synthesis are involved in regulating the increased PLD activity in senescing tissues (Ryu and Wang 1995).

Products of $PLA_2$ activity, lysophospholipids, are novel bioactive lipid molecules which retard plant senescence and stimulate cell growth. $PLA_2$ mediates numerous signal transduction pathways in animal systems. It was found that $PLA_2$-generated lysophospholipids act as novel lipid-derived growth regulators by retarding senescence of leaf, flower, and fruits as well as by stimulating plant cell growth.

$PLA_2$-generated lysophospholipids is specific inhibitors of PLD activity. Interestingly, lysophospholipids including LPE inhibited PLD activity *in vitro* in a highly specific manner (Ryu et al. 1997). LPE inhibition of purified cabbage PLD was dependent on the fatty acid chain length and the degree of unsaturation of LPE. LPE with longer and more unsaturated acyl chain was found to be more effective.

It is proposed that the interaction between PLD and $PLA_2$ may regulate plant growth and senescence. Since there is evidence for the inhibition of PLD by lysophospholipids, it is proposed that the lysophospholipids may play a role as cellular regulators of PLD *in vivo*. The further elucidation of cross-talk mechanisms between $PLA_2$ and PLD may provide better understanding on plant senescence process.

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## Chracterization of Protein Complexes Containing NDPK with Characteristics of Light Signal Transduction in Plant and Fungi

**Kohji Hasunuma and Naoto Yabe**

Kihara Institute for Biological Research and Graduate School of Integrated Science, Yokohama City University, Yokohama 244, Japan

Light signals constitute major factors in regulating gene expression and morphogenesis in plants and fungi. Phytochrome A and B were well characterized red and far-red light receptors in plants. Red light signals increased the phosphorylation of 18 KDa protein, which was identified to be nucleoside diphosphate (NDP) kinase. The NDP kinase catalyzed auto-phosphorylation and had a protein kinase activity phosphorylating myelin basic protein. As candidates for blue light photoreceptors, cDNAs for CRY 1 and CRY2 were isolated by the group of *A. cashmore*. The N-terminal regions of these proteins showed a high homology to DNA photolyase. The 120 KDa protein first detected in *Pisum sativum*, which showed blue light induced phosphorylation was also detected in *Arabidopsis thaliana* by the group of W. R. Briggs. The 120 KDa protein designated as phototropin was encoded by the nph 1 gene, which regulated positive phototropism of the plant. In *Neurospora crassa*, blue light irradiation of the membrane fraction prepared from mycelia stimulated the phosphorylation of the 15KDa protein, which was also identified to be an NDP kinase. Recent progress in understanding early events in light signal transduction mainly in *Pisum sativum* ALASKA, *Arabidopsis thaliana* and *Neurospora crassa* were summarized.