Structure-Function Similarities between a Plant Receptor-Like Kinase and the Human Interleukin-1 Receptor-Associated Kinase-4

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Collaborations

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Phylogenetic analysis has previously shown that plant receptor-like-kinases (RLKs) are monophyletic with respect to the kinase domain and share an evolutionary origin with the animal interleukin-1 receptor-associated kinase (IRAK)/Pelle soluble kinases. We have studied the lysin motif domain-containing receptor-like kinase-3 (LYK3) of the legume *Medicago truncatula*, which plays an important role in the nitrogen-fixing symbiosis with Rhizobia bacteria. Homology modeling with our partners in Grenoble revealed that the plant RLK contains structural features particular to this group of kinases, including the tyrosine gatekeeper and the N-terminal extension alpha-helix B. Functional analysis, with collaborators in Amsterdam, revealed the importance of these conserved features for kinase activity and suggests that kinase activity is essential for the biological role of LYK3. Mass spectrometry analysis, with the Proteomic Platform of the Toulouse Genopole, identified that LYK3 autophosphorylates on seven serine, eight threonine and one tyrosine residue. Functional analysis showed that three activation loop serine/threonine residues are required for biological activity and molecular dynamics simulations suggests that Thr475(170) is the prototypical phosphorylated residue which interacts with the conserved arginine in the catalytic loop, whereas Ser471(166) and Thr472(167) may be secondary sites (see Figure). We suggest that the structure-function similarities that we have identified between LYK3 and IRAK-4, may be widely applicable to plant RLKs in general.

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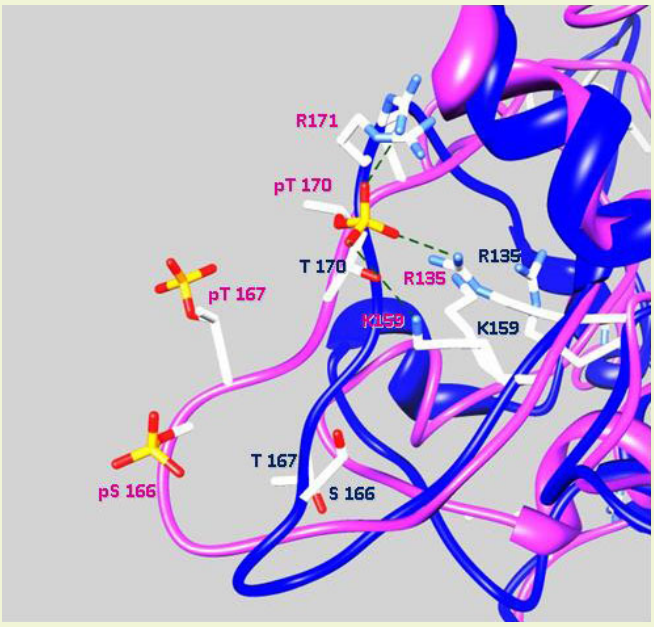

FIGURE. Comparison between the activation loops of the phosphorylated/unphosphorylated LYK3 kinase domains. Magenta ribbon and labels represent the phosphorylated structure whereas the blue ones represent the un phosphorylated model.

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