

*Abstract*

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**INTEGRATIVE PLANT BIOLOGY: Role of Phloem Long-Distance  
Macromolecular Trafficking**

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Abstract Recent studies have revealed the operation of a long-distance communication network operating within the vascular system of higher plants. The evolutionary development of this network reflects the need to communicate environmental inputs, sensed by mature organs, to meristematic regions of the plant. One consequence of such a long-distance signaling system is that newly forming organs can develop properties optimized for the environment into which they will emerge, mature, and function. The phloem translocation stream of the angiosperms contains, in addition to photosynthate and other small molecules, a variety of macromolecules, including mRNA, small RNA, and proteins. This review highlights recent progress in the characterization of phloem-mediated transport of macromolecules as components of an integrated long-distance signaling network. Attention is focused on the role played by these proteins and RNA species in coordination of developmental programs and the plant's response to both environmental cues and pathogen challenge. Finally, the importance of developing phloem transcriptome and proteomic databases is discussed within the context of advances in plant systems biology.