

The Journey of Small RNAs: Systemic and Interorganismal Signalling in Plants

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Small RNAs (sRNAs), including microRNAs (miRNAs) and small interfering RNAs (siRNAs), play central roles in regulating gene expression in plants. Beyond their local activity, many sRNAs are mobile, moving between cells and over long distances to coordinate developmental programs and environmental responses, establishing them as systemic signalling molecules. Recent research has also established sRNAs as important interorganismal information transmitters, mediating the interaction between plants and pathogenic or beneficial microbes.

It is a matter of debate how selective and regulated the process of sRNA transport is. It is also not well understood how sRNA transport functions. There is good evidence that RNA-binding proteins (RBPs) facilitate mobility while also stabilizing sRNAs. Stability during transport is further supported by their association with Argonaute proteins, biomolecular condensates, or membrane-surrounded extracellular vesicles.

Understanding sRNA transport has broad implications for both basic biology and agricultural biotechnology. By harnessing mobile sRNAs, it may be possible to design strategies for crop protection, nutrient management, and stress resilience. Our interdisciplinary research aims to uncover principles of sRNA selectivity, stability, targeting, and functional outcomes combining state-of-the-art molecular, biochemical, biophysical, and computational methods.

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