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Editor Note

# Editorial Note on New Generation of Bio Tools for Cellular Sensing, Biomedical Imaging and Bioenergy Research

**Alekhya Thirunahari***

*Department of Biotechnology, Osmania University, Telangana, India*

## EDITORIAL

Nanoprobes for cellular sensing and imaging, which enable selective and sensitive monitoring of bio-targets and molecular processes within and outside cellular systems, are urgently needed for research into plant biosystems relevant to biofuel production. Using surface-enhanced Raman scattering (SERS) detection, we create a new class of nanoprobes called inverse molecular sentinels (iMS) for nucleic acid targets (e.g., mRNAs, microRNAs, and siRNAs) that will enable imaging and analysis of cellular functions in both plant and microbial organisms.

A stem-loop nucleic acid probe labelled with a Raman reporter, which provides the source of the Raman signal; a plasmonicactive nanoparticle, such as nanospheres or nano-stars; and an unlabeled capture placeholder strand. As the placeholder capture strand is exposed to the target sequences, it leaves the "open" stem-loop probe, allowing the stem-loop to "close," and moving the Raman label onto the plasmonics-active metal surface, resulting in a powerful SERS signal. Because of the small Raman bandwidths, SERS' multiplex capability is a key feature that gives it a major advantage over other methods.

The ability of the iMS technique to target RGA and PP2AA3 genes in plant cells is demonstrated. In Arabidopsis, the RGA gene is part of the DELLA family of five genes that regulates plant biomass. The findings of this study show that using iMS nanoprobes for multiplex detection of important markers in bioenergy-relevant plant systems is feasible. By identifying and modulating DELLA expression in specific cell types, the results obtained with the iMS sensing technology will be useful in understanding and manipulating vegetative plant growth. Since DELLAs are important regulators of vegetative growth in flowering plants, our research will shed light on new ways to manipulate plant growth to increase biomass, which is essential for a sustainable and green future.

***Correspondence to:** Alekhya Thirunahari, MSc, Department of Biotechnology, Osmania University, Telangana, India, E-mail: thirunaharialekhya151315@gmail.com

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