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HOW SMALL REGULATORY MOLECULES ARE GENERATED IN PLANTS

Relevant for: Science & Technology | Topic: Biotechnology, Genetics & Health related developments

Control centre: Growth and development of plants are regulated at various levels in the cell. | Photo Credit: Ashoke Chakrabarty

Researchers from National Centre for Biological Sciences, Bengaluru, and SASTRA University, Thanjavur, have discovered how small molecules called microRNAs are made in plants. This finding makes it much easier for studying processes in plants. MicroRNAs are small molecules, about 21 nucleotides long, and help in controlling the levels of proteins in the cell. The research was published in the journal *Nucleic Acids Research.*

All aspects of growth and development of plants, whether it is initiation of flowering or control and distribution of hormones in response to external stress, are regulated at various levels in the cell. Such regulation is always mediated by proteins – the work horses of the cells. At one level, regulation of the processes is about controlling the amount of specific proteins being made in the cells. This is achieved by the microRNAs.

In order to decrease the level of a particular protein in specific cells, the microRNAs destroy the messenger RNA molecules that help with the production of that specific protein in the cell. The microRNA molecules do this by cutting down that particular messenger RNA thereby destroying it. This process is called the silencing of the messenger RNA. The microRNA that achieve this silencing are evolutionarily conserved – that is, they are found in all flowering plants, whether they are mosses or roses.

Similarly, the best way to study the effect of a gene in the DNA is to silence or “knockout” the gene. Knocking out a gene does not mean removing the entire gene. In knocking out processes, those RNA that induce the gene to produce proteins are destroyed or their levels are reduced by the microRNA as described earlier.

In this new research, the team has found that microRNAs have a high occurrence of the bases G and C and this helps their formation and abundance in the cells. Further, there is a position-specific bias for these bases in the microRNAs. This is recognised by a specific RNA-binding protein. As N. Anushree of NCBS, who is the first author of the paper clarifies, “We see more G or C in specific positions [across the length of the microRNA consisting of say, 21 nucleotides]. Such a preference is essential to make these molecules at an optimal level in the cells.”

The present way to silence genes is by introducing artificial microRNA which binds to the messenger RNA of interest and prevents the production of protein. This is done in a deliberate process of trial and error.

“Researchers try out several artificial microRNAs, introduce them into plants one by one in a cumbersome process and then pick the best one which can remove most messenger RNAs of the gene of interest. Our results can help anyone to choose the one candidate that is sure to work,” says P.V. Shivaprasad from NCBS, who led the study.

The WHO had to come up the name in line with the 2015 guidelines between the global agency, the World Organisation for Animal Health and the Food and Agriculture Organization.