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Opinion Article

A Brief Note on Transcriptional and Post-Transcriptional Gene Silencing

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DESCRIPTION

Gene silencing reduces the expression of some genes in humans naturally and response to environmental cues. Identifying an aberrant RNA through nonsense-mediated messenger RNA (mRNA) decay (NMD), which could be lethal if it persists in the cell's RNA plays a crucial part in plant defense systems. Transcriptional gene silencing (TGS) and post-transcriptional gene silencing (PTGS) are two types of gene silencing mechanisms in plants. A nuclear-localized mechanism called Kelly and TGS inhibits transcription by preventing the transcriptional machinery from attaching to a region of the promoter. TGS can be performed in a variety of ways, including position effect, genomic imprinting, transposon silencing, Para mutation, and RNA-directed DNA methylation (RdDM). Notably, transposon and transgene silencing is mostly accomplished via TGS. however just a minor part in this silence is played by PTGS.Position effect, also known as position variegation, is a type of gene silencing that was first identified in the fruit fly, *Drosophila melanogaster.* This paved the way for the investigation of additional potential gene silencing mechanisms in various organisms and opened up new research fields like genetics and functional genomics in a hit-and-trial experiment, a novel form of gene silencing phenomena called "co-suppression" was unintentionally identified in petunia after a year. When a virus-derived vector with an artificially created mRNA sequence encoding color pigments was introduced into a petunia plant, the resulting double-stranded RNA (dsRNA) molecules and the RNA-induced gene silencing complex (RISC), which cleaved every gene in the plant. DsRNA molecules of that particular gene and led to the phenotypic of an albino. For development, stress reactions, and the suppression of viruses, transposons, and transgenes, gene silencing is crucial. Transcriptional gene silencing is responsible for several epigenetic events, including X chromosome inactivation and genome imprinting (TGS). TGS can influence the expression of some transgenes as well as endogenous genes that are controlled by development or the environment. Because DNA methylation can prevent transcription factors from binding properly, it plays a significant role in TGS events. It has been demonstrated that DNA methyl transferases mutations release TGS of endogenous targets. Because mutations in the relevant components of this plant are not lethal, analysis of gene silencing frequently uses Arabidopsis as a model system. This allows for analysis of the impact on development and physiology throughout the plant's whole life. where Catalytic RNA molecules called ribozymes are utilized to stop gene expression.

Ribozymes

By cleaving mRNA molecules, these chemicals effectively silence the genes that produced them. In 1989, Sidney Altman and Thomas Cech made the initial discoveries of catalytic RNA molecules, RNase P, and group II intron ribozymes, for which they were awarded the Nobel Prize. Hammerhead, hairpin, hepatitis delta virus, a group I, group II, and RNase P ribozyme motifs are only a few examples of the various types of ribozyme motifs. In most viruses or viroid RNAs, hammerhead, hairpin, and hepatitis delta virus (HDV) ribozyme motifs are present Similar to alternative splicing.

Genomic imprinting

Genomic imprinting is an epigenetic process in which alleles of the same gene express differently depending on the parent of origin. The inactivation of entire chromosomes, such as the paternal X-chromosome in marsupials, may be impacted by genomic imprinting. Maternally expressed imprinted genes (MEGs) and paternally expressed imprinted genes are two forms of imprinted genes that differ in dominance (PEGs) Only the endosperm of flowering plants express all dominant imprinted genes in plants. The peripheral endosperm (PEN), micropylar endosperm (MCE), or chalazal endosperms are determined by the creation of separate mitotic domains after several nuclear divisions during the development of the endosperm (CZE). Notably, only 2% of plants and animals have imprinted genes, which are mostly expressed in the endosperm of CZE. For instance, the Pr1 reciprocal kernel-color allele of maize that is inherited maternally produces colored kernels as opposed to the paternally inherited allele that produces colourless or spotted kernels.

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