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How introns enhance gene expression

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Abstract

In many eukaryotes, including mammals, plants, yeast, and insects, introns can increase gene expression without functioning as a binding site for transcription factors. This phenomenon was termed 'intron-mediated enhancement'. Introns can increase transcript levels by affecting the rate of transcription, nuclear export, and transcript stability. Moreover, introns can also increase the efficiency of mRNA translation. This review discusses the current knowledge about these processes. The role of splicing in IME and the significance of intron position relative to the sites of transcription and translation initiation are elaborated. Particular emphasis is placed on the question why different introns, present at the same location of the same genes and spliced at a similar high efficiency, can have very different impacts on expression – from almost no effect to considerable stimulation. This situation can be at least partly accounted for by the identification of splicing-unrelated intronic elements with a special ability to enhance mRNA accumulation or translational efficiency. The many factors that could lead to the large variation observed between the impact of introns in different genes and experimental systems are highlighted. It is suggested that there is no sole, definite answer to the question "how do introns enhance gene expression". Rather, each intron-gene combination might undergo its own unique mixture of processes that lead to the perceptible outcome.

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