Abstract

Group I intron ribozymes share common core elements that form a 3D structure responsible for their catalytic activity. This core structure is unstable without assistance from additional factors that stabilize its tertiary structure. The ΔP5 ribozyme is a typical derivative composed only of the core structure. To see polyamines effect as activators for the ΔP5 ribozyme, I examined (1) biogenic triamine and tetraamine and also their component diamines, (2) four polyamines sharing dimethylene units, and (3) eight stereoisomer of synthetic pentamines bearing three cyclopentene rings. Firstly, biogenic spermidine and spermine efficiently activated the structurally unstable ΔP5 ribozyme under conditions where the ribozyme was nearly inactive. Spermine was the most effective activator than spermidine and two component diamine due to multivalent effects of amine moieties. Multiple amine moieties in one molecule have stronger impact on the ribozyme structure at lower Mg^{2+} concentration. Secondly, among polyamines with dimethylene units, triethylenetetramine and tetraethylenepentamine activated the ΔP5 ribozyme most and least efficiently, respectively. An increase in the number of amine moieties improved the activating ability of polyamines, although there were exceptions in diethylene triamine. Though the comparision of the first and second research data suggest that, trimethylene and tetramethylene linker seem more suitable than dimethylene linker to arrange amine moieties. Thirdly, among eight rigid pentamine stereoisomers, three stereoisomers exhibited distinct effects as an

inhibitor, an additive with a neutral effect, and also as an activator due to their distinct stereo-structures with considerable rigidity. Restriction of structural flexibility of polyamines may allow them to emphasize particular modulation effects. This study showed that structurally rigid polyamines may be a promising class of molecules to modulate functional RNAs with marginally stable structures.