

[PS1.47]

**Riboswitch is a regulator of the noise in mRNA levels**

Kandhavelu Meenakshisundaram\*, Lihavainen Eero, Healy Shannon, Lloyd-Price Jason,  
Chowdhury Sharif, Hakkinen Antti et al  
*Thampere University of Technology, Finland*

Riboswitches are structural domains in messenger RNA and contribute to the regulation of gene expression in prokaryotes and eukaryotes. Riboswitches bind specific metabolites which leads to conformational changes in the mRNA-encoded gene. These mRNA elements form specific binding pockets (aptamer) for the small metabolites which are involved in the formation of alternative structures of the mRNA. It also regulates the transcriptional and translational machinery of downstream genes. Here, we report the first evidence of a riboswitch influencing the real-time kinetics of single gene expression at the molecular level by tracking fluorescent labeled mRNAs in *E.coli*. The results are visualized by live cell imaging. The riboswitch is found to have an important role in shaping the distribution of number of mRNA molecules in cells of a population of *E.coli*. We also find that extracellular metabolites can be sensed by the mRNA to regulate disparate steps in gene transcription: one conformational change in mRNA is favoured in low metabolite concentration which increases the transcription, and another is favoured for higher metabolites concentrations and can perturb the transcription rate. Further, we infer the riboswitch regulation at the translational level using high-throughput screening; the results confirm the effects of the riboswitch in mRNA expression level dynamics and also that it affects protein expression dynamics. We show that the methods used here allow better understanding of the effects of riboswitches on the dynamics of RNA transcription *in-Vivo*. Stochasticity in mRNA level arising from the riboswitch machinery is likely to be evolvable because it is sequence dependent.

Keywords: Riboswitch, Live cell kinetics, Single mRNA, Stochasticity